

CHISHOLM, M.B.

The Evaluation of Three programs for Teaching  
Arithmetic in Grade one.

Thesis 1949

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Thesis

THE EVALUATION OF THREE PROGRAMS  
FOR TEACHING ARITHMETIC IN GRADE ONE

Submitted by

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(B.S. in Education, Bridgewater State Teachers College)  
1939

In partial fulfillment of requirements for  
the degree of Master of Education  
1949

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First Reader: Helen A. Murphy, Associate Professor of Education

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## INTRODUCTION

The purpose of this study is to evaluate three programs for teaching arithmetic in Grade One. In the first program an incidental approach is used. In the second program a commercial workbook is used. The third program is one planned by the writer to use concrete and semi-concrete materials in the development of arithmetic concepts in Grade One.



## CHAPTER I

### SUMMARY OF PREVIOUS RESEARCH

The following summary of research studies on arithmetical backgrounds of school entrants is in two sections. The first section is organized according to the six stages in the counting process listed by Brueckner and Grossnickle<sup>1/</sup> as follows:

- (1) Rote counting
- (2) Enumeration
- (3) Identification
- (4) Reproduction
- (5) Comparison
- (6) Grouping

The second section is devoted to research studies based on other arithmetical knowledge of the entering pupil.

#### Section 1

Rote counting by ones.--Buckingham and MacLatchy<sup>2/</sup> conducted an investigation involving first-grade entrants in cities and villages in Ohio and Texas. These authors included

<sup>1/</sup>Brueckner, Leo J. and Grossnickle, Foster E. How to Make Arithmetic Meaningful. The John C. Winston Co. Philadelphia, 1947, p. 170.

<sup>2/</sup>Buckingham, B. R. and MacLatchy, Josephine H. "Number Abilities of Children When They Enter Grade One". Report of the Society's Committee on Arithmetic. Twenty-Ninth Yearbook, National Society for Study of Education. Bloomington, Ill. Public School Publishing Co. 1930, pp. 473-524

THE  
HISTORY OF THE  
CITY OF BOSTON

FROM THE FIRST SETTLEMENT  
TO THE PRESENT TIME  
BY  
JOSEPH NEALE, ESQ.

IN TWO VOLUMES.  
VOLUME THE SECOND.  
CONTAINING  
THE HISTORY OF THE  
CITY OF BOSTON  
FROM THE YEAR 1630  
TO THE PRESENT TIME.

LONDON:  
Printed by J. NEALE, at the Sign of the Anchor, in St. Dunstons Church-yard, near St. Dunstons Church, in the County of Middlesex.

1790.

THE SECOND VOLUME OF THE HISTORY OF THE CITY OF BOSTON, CONTAINING THE HISTORY OF THE CITY OF BOSTON FROM THE YEAR 1630 TO THE PRESENT TIME, BY JOSEPH NEALE, ESQ.

IN TWO VOLUMES. VOLUME THE SECOND. CONTAINING THE HISTORY OF THE CITY OF BOSTON FROM THE YEAR 1630 TO THE PRESENT TIME.

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also the city of Cincinnati in this investigation, receiving returns on about 1,110 children in that city. Findings from the two groups tested were separated into the so-called Main Study and the Cincinnati Study. The following data from these studies show the per cents of children who counted accurately by ones to given numbers:

	<u>Main Study</u> (1356 children)	<u>Cincinnati Study</u> (1067 children)
Counting to 11	89.1	88.6
Counting to 20	59.0	63.3
Counting to 100	11.9	10.7

Through the courtesy of Director William L. Connor of Cleveland, Buckingham and MacLatchy report also the findings of a Cleveland study made at the same time as their Main study and having a similar purpose. On the Cleveland study is reported:

"In rote counting by ones, returns were received from 313 C. (Cleveland) children, of whom 18 per cent counted correctly to 50 or higher....Seventy-six per cent of the C. children counted to 20 or more....Ninety-seven per cent of the C. children could count at least to 10."

Brownell<sup>1/</sup> reports a study conducted on 631 school entrants in 24 schools in rural communities or cities in Florida, North Carolina, Pennsylvania, and Virginia. Of the 631 children included in the study 90% could count through 10 by ones and 52% could count by ones to 20.

<sup>1/</sup>Brownell, William A. "Arithmetic in Grades I and II." Duke University Research Studies in Education Number 6. Duke University Press. Durham, North Carolina, 1941.



- Woody<sup>1/</sup> finds in an inventory test given in 39 different school systems throughout the United States that of the 94 kindergarten children tested, 26% counted by ones to 100, of the 604 children in Grade IB, 38% counted by ones to 100, and also successfully counting in this manner were 66% of the 1897 children in Grade IA.

In an investigation involving 125 children ages three to six years, McLaughlin<sup>2/</sup> finds the following data on rote counting by ones:

"All the three-year olds counted by rote to two and 69.2 per cent counted to 4. One child counted to 12. Among the four-year-olds 51 per cent counted beyond 12; 18 per cent reached 20 and 12 per cent went beyond this point....

"Rote counting is more conspicuously developed in the fifth than in the two earlier years. Fifty-five per cent of the group reached the second decade, of these 22.5 per cent counted several decades beyond, and 12.5 per cent counted to 100."

Stotlar<sup>3/</sup> reports the following results obtained on testing 19 children from 50 to 69 months when these were asked to count as far as they could:

"One child was able to count to 100 by rote....Sixty-eight per cent of the children could successfully count to between 10 and 30, and 26 per cent of the children could count only to 6 or less."

1/ Woody, Clifford. "Arithmetical Backgrounds of Small Children" Journal of Educational Research, V24. October, 1931, pp.188-201

2/ McLaughlin, Katherine. "Number Ability of Preschool Children" Childhood Education V.11. May, 1935, pp.348-353

3/ Stotlar, Carolyn. "Arithmetic Concepts of Preschool Children" Elementary School Journal V.46. February, 1946, pp.342-345

1. The first part of the report deals with the general situation of the country and the progress of the work during the year. It also mentions the results of the various committees and the work of the different departments.

2. The second part of the report deals with the financial situation of the country and the progress of the work during the year. It also mentions the results of the various committees and the work of the different departments.

3. The third part of the report deals with the social situation of the country and the progress of the work during the year. It also mentions the results of the various committees and the work of the different departments.

4. The fourth part of the report deals with the cultural situation of the country and the progress of the work during the year. It also mentions the results of the various committees and the work of the different departments.



Yokum<sup>1/</sup> tested 50 boys and 50 girls on the first day of school and reports that 20% of the boys and 20% of the girls could count by rote higher than 20.

Counting by tens.--In the study conducted in Ohio, Texas and Cincinnati, Buckingham and MacLatchy<sup>2/</sup> make these statements concerning counting by tens:

"Eleven hundred twenty-one usable returns were received on this topic.... Fully fifty per cent of the children were either unable to count by tens at all or were able to count to 100. About 25 per cent of them counted to 100. Rather more than 25 per cent failed altogether. Fully half of them counted at least as far as 40."

The following are the percents reported on the Main study and the Cincinnati study as conducted by Buckingham and MacLatchy<sup>3/</sup>:

	<u>Main Study</u> (1356 entrants)	<u>Cincinnati Study</u> (1035 entrants)
Counting to 40 by tens	27.3%	28.9%
Counting to 100 by tens	26.3%	22.3%

Woody<sup>4/</sup> finds the following data on counting by tens:--Of the 94 kindergarten children tested 32% counted to 100; of the 604 Grade IB children tested 46% counted to 100; of the 1897 Grade IA children tested 69% counted to 100.

1/Yokum, Albert D. An Inquiry into the Teaching of Addition and Subtraction. Philadelphia Civil Printing Co. 1901, pp. 13-14

2/Buckingham B. R. and MacLatchy, Josephine H. op. cit. 473-524

3/Ibid, p. 473-524

4/Woody, Clifford, op. cit. p. 188-201

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Counting by twos.--Woody adds to his above findings on rote counting the following data on counting by twos:--Of the 94 kindergarten children tested, 7% counted by twos to 30; of the 604 Grade IB children tested, 14% counted by twos to 30; of the 1897 IA children tested, 34% counted by twos to 30.

Rote counting.--In a summary of her report on an experiment with 44 children in the Laboratory School of Southern Illinois Normal University, Mott<sup>1/</sup> reports that of the 23 children entering school in the fall, 96 per cent could count by rote beyond 10, 82 per cent could count to 15, 30 per cent beyond 20 and 22 per cent to 100.

Wittich<sup>2/</sup> administered a number readiness test at the beginning of school to 76 children ages 5 years, 5 months, to 7 years, 1 month. Of this number it was found that all could count orally to ten by ones, and 15 of the group could count over 100.

Enumeration.--McLaughlin<sup>3/</sup> refers to this ability to enumerate or use number names in counting objects as "rational" counting and says of it:

"Rote counting employs simple recall of verbal numerals in correct serial order, but rational counting uses this function and besides, requires

<sup>1/</sup> Mott, Sina M. "Number Concepts of Small Children," Mathematics Teacher, 38 (November, 1945): 291-301

<sup>2/</sup> Wittich, Walter A. "A Number Readiness Test," The School Executive, Vol. 61 (March, 1942): 11-13

<sup>3/</sup> McLaughlin, Katherine, op. cit. p.348-353





the matching or tallying of the correct verbal numerals with the corresponding objects being discriminated.

"That is, rational counting employs a relational form of thinking which holds the two factors, number names and discriminated objects, together in one-to-one relation.

"Rational counting is thus seen to involve complex mental activities."

This same author reports on her investigation including 125 children from 3 years to 6 years of age. She also included a few two-year-old children to "determine to what extent discrimination of objects in a series was observable." The following include results obtained on the two-year-old children and also those older:

"One child, twenty-seven months old, pointed to the separate items arranged in a row saying as he touched each, 'Dee-dee-dee.' Three others a few months older used the terms, "dee-one, dee-one, dee-one" or "dat-one, dat-one, dat-one" or "one, one, one."

"This immature form of response is replaced later, as was shown on the individual records of the three-year-old children, by the first terms of the numeral series. Inability to master the idea of correspondence limits rational counting for three-year-olds to approximately the first decade; 61 per cent of the group reached 4 and one child counted to 11. In the fourth year two-thirds, and in the fifth all but one child bridged the first decade; 15.1 per cent of the fourth and 47.5 per cent of the fifth-year group counted beyond 20; a few reached 100. Throughout the three successive years there was a steady advance in ability to enumerate correctly the items in the concrete series, though, in general, achievement in rational counting was less than that in rote until the first three or four decades were reached."

Of the 631 school entrants tested in his study, Brownell<sup>1/</sup>

1/Brownell, Wm. A. "Arithmetic in Grades I and II," Duke University Research Studies in Education No. 6. Durham, N.C. 1941





reports 99 per cent counted five objects correctly, 93 per cent counted eight, and 89 per cent counted ten in response to the direction, "Here are some pegs, (or small objects scattered at random). I want you to tell me how many you have." The child was required to touch each object as the number name was said, "thus to show that he actually has established a one-to-one correspondence between the series of language terms and the objects in the group."

To test the ability of school entrants to enumerate, Buckingham and MacLatchy<sup>1/</sup> required the children to count as many as they could of the 20 objects placed before them. Of the 1222 children in the Main Study 70 per cent counted at least 15 objects; over 90 per cent counted at least ten objects; 58 per cent counted all objects correctly.

In their Cincinnati Study of 1014 children these authors report that 75 per cent counted to 15; 90 per cent counted to ten; and 62 per cent counted all objects correctly.

From the Cleveland data (through the courtesy of Director William L. Connor) come these data obtained when 1242 kindergarten children followed directions to put twenty tacks into a board:-26 per cent were successful on two trials and 22 per cent were successful on one trial.

Buckingham and MacLatchy<sup>2/</sup> concluded another test in their study. This required the naming of the number of objects

---

<sup>1/</sup>Buckingham and MacLatchy op. cit. p. 473-524  
<sup>2/</sup>Ibid p. 500

The first part of the report deals with the general situation of the country and the progress of the work during the year. It is followed by a detailed account of the various projects and the results achieved. The report concludes with a summary of the work done and the plans for the future.

The second part of the report contains a list of the names of the persons who have been engaged in the work during the year. It also contains a list of the names of the persons who have been engaged in the work during the year.

The third part of the report contains a list of the names of the persons who have been engaged in the work during the year. It also contains a list of the names of the persons who have been engaged in the work during the year.

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The tenth part of the report contains a list of the names of the persons who have been engaged in the work during the year. It also contains a list of the names of the persons who have been engaged in the work during the year.

placed at random before the child tested. The authors evaluate the term "naming" in this statement:

"It is to be understood, however, that naming includes something more. It includes enumeration of a group of objects, the determination of how many objects there are in the group, and then giving the correct name to this number."

In the Main Study these authors find that of the 1356 children tested, the following named the numbers correctly:

81.5	per cent	named	five
75.0	"	"	six
74.3	"	"	seven
72.2	"	"	eight
70.4	"	"	ten

From the Cincinnati data of the 1123 children tested comes the following figures:

80.2	per cent	named	five
68.5	"	"	six
62.9	"	"	seven
62.6	"	"	eight
60.2	"	"	ten

From Woody's<sup>1/</sup> experiment come the following data:

Of the 94 kindergarten children 71 per cent counted 20 circles

Of the 604 Grade IB children 79 per cent counted 20 circles

Of the 1897 Grade IA children 93 per cent counted 20 objects

<sup>1/</sup> Woody, Clifford op. cit. p. 188-201

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF CHEMISTRY

RESEARCH REPORT  
No. 1000

THEORY OF THE ELECTROLYTIC DECOMPOSITION OF  
SOLUBLE ELECTROLYTES

BY  
J. H. VAN NUNN  
AND  
J. H. VAN NUNN

RECEIVED JANUARY 10, 1930

THEORY OF THE ELECTROLYTIC DECOMPOSITION OF  
SOLUBLE ELECTROLYTES

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THEORY OF THE ELECTROLYTIC DECOMPOSITION OF  
SOLUBLE ELECTROLYTES

The same author makes these statements on the results of his testings:

"(1) The children have considerable knowledge of counting even though formal instruction in the subject has not begun; (2) the percentage of correct responses increases from Grade to Grade; (3) the exercises involving counting twenty circles and counting them in order proved easier than rote counting by 1's or 10's; (4) the exercise involving rote counting to 100 by 10's was easier than that involving counting to 100 by 1's."

Of the 50 boys tested on the first day of school by Yokum<sup>1/</sup> 32 per cent could count with objects higher than 20.

Of the 50 girls tested 38 per cent could count higher than 20.

Stotlar's<sup>2/</sup> test on 19 children reveals that in counting 28 blocks:

"16 per cent were able to count to or above 28. Fifty-three per cent of the children counted to between 10 and 17, and 32 per cent counted seven or fewer blocks. Of these, two had no concept of numbers of objects. According to these tests, there is no marked difference in the children's ability to count by rote and their number concept. Both are developing at about the same rate."

Grant<sup>3/</sup> states that:

"The counting of objects using cardinal numbers seems generally to be better understood than the counting of objects in ordinal relationship. However, the latter ability, among beginning

1/Yokum, Albert D. op. cit. p. 13-14

2/Stotlar Carolyn op. cit. p. 342-345

3/Grant, Albert. "An Analysis of the Number Knowledge of First-Grade Pupils According to Levels of Intelligence." Journal of Experimental Education, 7 (September, 1938, p. 63-66



THE HISTORY OF THE UNITED STATES OF AMERICA

CHAPTER I  
THE DISCOVERY OF AMERICA  
The first discovery of America was made by Christopher Columbus in 1492. He sailed from Spain and reached the island of San Salvador in the Bahamas. This was the first of many voyages that he made to the New World. His discovery opened up a new era of exploration and trade between Europe and the Americas.

CHAPTER II  
THE EARLY SETTLEMENTS  
The first permanent European settlement in North America was founded by the Pilgrims in 1620. They came to the Massachusetts coast and established the town of Plymouth. Other early settlements were founded by the French, Spanish, and Dutch.

CHAPTER III  
THE REVOLUTIONARY WAR  
The Revolutionary War was fought between the American colonies and Great Britain from 1775 to 1783. The war was fought for the right of the colonies to be independent of British rule. The war ended with the signing of the Treaty of Paris in 1783, which recognized the United States as an independent nation.

CHAPTER IV  
THE WESTERN EXPANSION  
The Western Expansion was a period of time when the United States expanded its territory westward. This was done through a series of wars and treaties, including the Louisiana Purchase of 1803. The expansion led to the discovery of gold and other valuable resources in the West.

CHAPTER V  
THE CIVIL WAR  
The Civil War was fought between the Northern states and the Southern states from 1861 to 1865. The war was fought over the issue of slavery. The Northern states wanted to abolish slavery, while the Southern states wanted to keep it. The war ended with the Union's victory and the abolition of slavery.



first grade pupils of the same age, is also closely related to their level of intelligence."

Mott<sup>1/</sup> makes this statement about object counting:

"The fact that almost half the children of this age (51 months to 70 months) are counting objects beyond their rote counting indicates the fact that rote counting is not a necessary prelude to object counting."

Identification:--Brownell<sup>2/</sup> says of identification,

"Closely related to ability in enumeration is the ability to identify or name the number of objects in groups of various sizes." This same author in a test given to 692 school entrants gives the following per cents of those successfully following directions to "put a mark on the man with four balloons; on Mary's birthday cake with seven candles; on the pot with ten flowers":

83.8	per	cent	identified	four
70.9	"	"	"	seven
78.5	"	"	"	ten

In the interview test given by Buckingham and MacLatchy<sup>3/</sup> the following percentages are given for those successfully identifying the number of objects scattered at random before them:

Of the 1123 children tested in the Main Study who were

<sup>1/</sup>Mott, Sina M., "Number Concepts of Small Children." The Mathematics Teacher 38 (November, 1945). p. 291-301

<sup>2/</sup>Brownell, William A. op. cit. p. 20

<sup>3/</sup>Buckingham, B. R. and MacLatchy, J. H. op. cit. p. 473-524

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

REPORT OF THE

COMMISSIONER OF THE

STATE OF CHICAGO

FOR THE YEAR 1891

CHICAGO: PUBLISHED BY THE

STATE OF CHICAGO

successful in three trials at this test:

62.5	per	cent	for	five
51.9	"	"	"	six
46.4	"	"	"	seven
45.1	"	"	"	eight
42.1	"	"	"	ten

In this same test administered in Cincinnati, the percentages of the 1123 children tested are given as:

80.2	per	cent	identified	five
68.5	"	"	"	six
62.9	"	"	"	seven
62.6	"	"	"	eight
60.6	"	"	"	ten

Brownell<sup>1/</sup> reports on a test by Woody<sup>2/</sup> involving 1897 Grade IA pupils. Woody finds that 91% can identify five, 86 per cent can identify seven, 75 per cent can identify nine, and 80 per cent can identify ten.

Reproduction.--Brownell<sup>3/</sup> differentiates between identification and reproduction in this statement:

"Identification is the activity by which one answers the question, 'How many apples have I?' Reproduction, on the other hand, is the activity in which one engages to comply with the request, 'Give me five apples.' In the case of identification a group of objects is given and their number must be found;

<sup>1/</sup>Brownell, William A. op. cit. p. 24

<sup>2/</sup>Woody, Clifford. "Knowledge of Arithmetic Possessed by Young Children." Bulletin of the School of Ed. Indiana Univ. VI (July, 1930 ) p. 50-85

<sup>3/</sup>Brownell, William A. op. cit. p. 25

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the transparency and accountability of the organization. This section also outlines the various methods used to collect and analyze data, ensuring that the information is reliable and up-to-date.

2. The second part of the document focuses on the financial aspects of the organization. It provides a detailed overview of the budget, including the projected income and expenses for the upcoming year. This section also discusses the various financial risks and how they are being managed to ensure the organization's financial stability.

3. The third part of the document addresses the operational aspects of the organization. It describes the various processes and procedures that are in place to ensure the efficient and effective delivery of services. This section also discusses the various challenges that the organization is facing and how they are being addressed.

4. The fourth part of the document discusses the human resources of the organization. It provides a detailed overview of the current staff and the various roles and responsibilities of each employee. This section also discusses the various training and development programs that are in place to ensure that the staff is equipped with the necessary skills and knowledge to perform their duties effectively.

5. The fifth part of the document discusses the legal aspects of the organization. It provides a detailed overview of the various laws and regulations that the organization is subject to and how they are being complied with. This section also discusses the various legal risks and how they are being managed to ensure the organization's legal compliance.

6. The sixth part of the document discusses the environmental aspects of the organization. It provides a detailed overview of the various environmental issues that the organization is facing and how they are being addressed. This section also discusses the various environmental risks and how they are being managed to ensure the organization's environmental sustainability.

7. The seventh part of the document discusses the social aspects of the organization. It provides a detailed overview of the various social issues that the organization is facing and how they are being addressed. This section also discusses the various social risks and how they are being managed to ensure the organization's social responsibility.

8. The eighth part of the document discusses the overall performance of the organization. It provides a detailed overview of the various key performance indicators (KPIs) that are being used to measure the organization's performance. This section also discusses the various challenges that the organization is facing and how they are being addressed.

9. The ninth part of the document discusses the future of the organization. It provides a detailed overview of the various strategic initiatives that are being implemented to ensure the organization's long-term success. This section also discusses the various risks and opportunities that the organization is facing and how they are being managed.

10. The tenth part of the document discusses the conclusion of the report. It summarizes the key findings of the report and provides a final overview of the organization's performance and future prospects.

in the case of reproduction the number is given or announced and the corresponding group of objects must be found. The mental processes required in the two number feats are markedly different."

In this author's study of school entrants the directions for testing this mental process were:

1. "This boy wants to play marbles. Draw five marbles for him.
2. "Look at the umbrellas. They have no handles. Put handles on six of them." (Nine umbrellas are pictured in the test.)
3. "Do you see the rabbits? They have no tails. Put tails on nine of the rabbits." (Ten rabbits are pictured.)

Of the 692 children tested

79.9 per cent reproduced five correctly

60.5 " " " six "

53.8 " " " nine "

Brownell<sup>1/</sup> concludes:

"So far as the separate numbers 5, 6, and 9 are concerned difficulty in reproduction is seen to have increased with the size of the groups to be reproduced."

Buckingham and MacLachy<sup>2/</sup> reporting on the results obtained by Connors in Cleveland say that of the 1242 children tested 32 per cent succeeded

"in both trials of a test in which they were to reproduce the numbers 5, 7, 9, and 11 by putting the required number of marks in designated spaces on a sheet of paper. According to the marking

<sup>1/</sup>Brownell, William A. op. cit. p. 25

<sup>2/</sup>Buckingham, B. R. and MacLachy, J. H. op. cit. p. 510







plan for this test, the highest obtainable score was 10, and the median of all the scores actually made was 8."

These authors required that those tested in their study of school entrants be able to hand to the teacher the required number of objects in response to the direct, "Give me five." Of the 1355 tested in their Main Study the following percentages reproduced once correctly the following numbers:

85.3	per	cent	reproduced	five
80.3	"	"	"	six
80.7	"	"	"	seven
78.0	"	"	"	eight
76.6	"	"	"	ten

From the Cincinnati study the above authors report that on this same test these percentages reproduced the numbers correctly:

83.2	per	cent	reproduced	five
73.4	"	"	"	six
71.7	"	"	"	seven
67.5	"	"	"	eight
67.0	"	"	"	ten

Comparison.--A portion of Brownell's<sup>1/</sup> test deals with comparison. Relative to this Brownell says:

"Under this caption are included such terms like largest, shortest, most, and so on, a total of eleven such terms by means of which one describes crude differences in size or amount without attempting to fix exactly the degree of the difference."

<sup>1/</sup>Brownell, William A. op. cit. p. 28



Of the 692 school entrants Brownell<sup>1/</sup> tested he finds the following successfully identifying the following terms:

Largest.....	83.7	per cent	
Smallest.....	79.2	"	"
Longest.....	93.9	"	"
Shortest.....	89.5	"	"
Most (eggs in nest)....	96.8	"	"
Most (apples on tree).. <td>97.4</td> <td>per cent</td> <td></td>	97.4	per cent	
Fewest.....	63.7	"	"

Brownell reports data obtained by Woody<sup>2/</sup> when he tested children from kindergarten through Grade IIA. For Grade IA pupils the percentage succeeding on all combined items was 17 per cent. In the test were items, twenty-two in number, and some dealing with the abstract, as "Which is more, 2 or 4?" and those dealing with the more concrete as "Which is most, 11 cookies, 7 cookies, or 9 cookies?"

Russell<sup>2/</sup> tested pupils in kindergarten, first and second grades. Questions in this test involved the words, "most", "more," "least", "less", "equal." The author notes these outcomes:

1. "The results lead to the conclusion that the child's first concept of number is a manyness from which the quantity and serial aspects of number differentiate. Data were presented to show that the

1/Brownell, William A. op. cit. p. 28

2/Woody, Clifford op. cit. p. 50-85

3/Russell, Ned. "Arithmetical Concepts of Children." Journal of Educational Research, 29 (May, 1936) p. 608





differentiation is a gradual process which, at the seven-year-old level and beyond does not reach the adult's conception of the cardinal and ordinal ideas of number.

2. "The present study substantiates the hypothesis that the cardinal and ordinal number concepts develop simultaneously. Ability to count, in itself, is not a reliable measure of this development.
3. "The child, four-and-a-half to five years of age, readily understands the terms 'most', 'both', and 'biggest.' Words denoting 'same' and 'equal' are not comprehended. The child can compare groups of blocks up to ten with remarkable accuracy, although he has a visual notion only of three or, perhaps, of four.
4. "The seven-year-old child uses such terms as 'many', 'most', and 'more.' The words 'same' and 'equal' are not fully comprehended. Counting by ones is a difficult method for differentiating groups and is not accurate above five. The child will form sub-groups first which have unequal value mathematically. At a later stage in the differentiation process, counting by ones is employed.
5. "It is likely (as many have maintained) that the first grade pupil will be mature enough to master completely and understand isolated addition and subtraction facts. Formal work such as drill over these arithmetic facts should be discouraged. The observations indicated that the initial training in arithmetic should be undertaken with the use of concrete materials."

Grant<sup>1/</sup> analyzed according to levels of intelligence the responses of 563 children entering first grade when Test 5 of the Metropolitan Readiness Tests<sup>2/</sup> was administered. Relative

<sup>1/</sup>Grant, Albert. "An Analysis of the Number Knowledge of First-Grade Pupils According to Levels of Intelligence." Journal of Experimental Education, 7 (Sept., 1938) p. 63

<sup>2/</sup>Hildreth, Gertrude and Griffeths, Nellie. Metropolitan Readiness Tests. World Book-Co., 1933. Yonkers-on-Hudson, New York

The first part of the report deals with the general situation of the country and the progress of the work during the year.

The second part of the report deals with the results of the work during the year and the progress of the work during the year.

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The ninth part of the report deals with the results of the work during the year and the progress of the work during the year.



to the portion of the test dealing with number terms, Grant States:

"Over two-thirds of the 'dull', over four-fifths of the 'average', and practically all of the 'brightest' understand the following number terms: 'longest', 'middle', 'shortest', 'tallest', 'widest', and 'smallest.' The terms 'half' and 'as long as' are understood by smaller portions of the group."

Grouping.--Deans<sup>1/</sup>, concerned with the fact that children solve quantitative problems on the level easiest to them, that of one-to-one counting, exhorts teachers to stress more this phase in number experience. This author says of grouping:

".....teachers must consciously and persistently try to help children to think in terms of groups, thereby moving one step beyond the counting level."

".....this stage of number learning is recognized by many experts in the field to be a weak spot in the experiences of most children. If grouping does not normally occur then it must be planned for if progression in learning is to be assured."

Carper<sup>2/</sup>, testing nearly 300 school entrants, reports that 81 per cent grouped three, 66 per cent grouped four, and 52 per cent grouped five. This author cautions that success in grouping pictured objects is affected by "(1) the kind of imbedding (context) of the units with which the child must deal, (2) the form or shape of the objects, and (3) the pattern or arrangement of the objects in the group."

<sup>1/</sup>Deans, Edwina. "Children's Experiences and the Development of Quantitative and Qualitative Concepts." This is Arithmetic Bulletin of the Assoc. for Childhood Education. Washington, D.C. Association for Childhood Education, 1945. p. 12

<sup>2/</sup>Carper, Doris V. "Seeing Numbers as Groups in Primary-Grade Arithmetic." Elementary School Journal, 43 (November, 1942) p. 166-170



This author goes on to say:

"When the simple geometric units, arranged in a regular pattern, appeared with no background the portion of the five-year-olds who grouped the units was fairly large. Of these, 77.8 per cent could group three, 36.4 per cent could group four and five. When the simple outline was put around the results were less favorable. 58.3 per cent could group three, 29.1 per cent could group four or five. When the background or figures were even more complex were 49.9 per cent for three, 19.1 per cent for four and five on one test and on a more complex arrangement 29.4 per cent for three, and 1.5 per cent for four and five. Thus it is seen that success decreased as complexity of background of the test increased.

"It was also found that those obtaining answers by grouping were fewer in number as the units varied from:

"(1) compact units - - circles and squares

"(2) fairly compact units - - bunnies and dogs, and

"(3) less compact units - - stick men and birds.

"It is interesting to note that the percentage of pupils recognizing groups of four and five as dots were arranged in an irregular pattern was only one-eighth the percentage able to recognize groups of four and five arranged in a regular pattern."

McLaughlin<sup>1/</sup> tested 125 children in ages from three to six years and reports the following:

"The methods of response showed advance in maturity from age to age. All but one of the three-year-olds sensed the problem of matching (matching a collection of concrete items with a like numbered collection); some matched two and three but laid down handfuls for larger numbers to indicate their idea of 'many' and hence had too many objects to count. Brighter

<sup>1/</sup>McLaughlin, Katherine "Number Ability of Pre-School Children." Childhood Education, 11 (May, 1935) p. 348-353

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that this is essential for the proper management of the organization's finances and for ensuring transparency in all dealings.

2. The second part of the document outlines the various methods used to collect and analyze data. It describes how this information is used to identify trends, assess performance, and make informed decisions about future operations.

3. The third part of the document focuses on the role of the management team in overseeing the organization's activities. It highlights the need for clear communication, effective delegation, and a strong commitment to the organization's goals.

4. The fourth part of the document discusses the importance of maintaining high standards of quality in all work. It explains how this is achieved through regular monitoring, feedback, and continuous improvement efforts.

5. The fifth part of the document addresses the issue of employee development and training. It describes the various programs and initiatives in place to help staff members grow their skills and advance their careers within the organization.

6. The sixth part of the document discusses the importance of maintaining a safe and healthy work environment. It outlines the various measures taken to ensure the well-being of all employees and to prevent accidents and injuries.

7. The seventh part of the document discusses the importance of maintaining a strong relationship with the community. It describes the various ways in which the organization engages with its stakeholders and promotes its values and mission.

8. The eighth part of the document discusses the importance of maintaining a strong financial position. It outlines the various strategies used to manage the organization's resources and ensure its long-term sustainability.

9. The ninth part of the document discusses the importance of maintaining a strong legal and ethical framework. It describes the various policies and procedures in place to ensure that the organization operates in a lawful and ethical manner.

10. The tenth part of the document discusses the importance of maintaining a strong reputation. It outlines the various ways in which the organization promotes its brand and ensures that it is perceived as a leader in its field.



ones identified groups by counting but for them 'how many' was still the counting of separate units. One child had advanced to the point where he could recognize two and three without counting, and four as two twos.

"Among four-year-olds the idea of 'many' was designated by a favorite number, ten-two, twenty-ten, and the like; two and three were readily recognized without counting; larger numbers were attacked at once by counting or were broken up into twos, threes, or more rarely, into fours or fives; counting as a means of matching, forming, discriminating or naming number groups while few four-year-olds failed to realize this fact; one subject who ranked highest in general intelligence responded to three, four, and five by beginning with two and counting to the remainder one at a time.

"Practically all five-year-olds recognized two and three at a glance; four was often so recognized, but to many it was two twos or 'chee' and one more; high scores were made by good 'counters'."

The same author also concludes that

".....the order of development is from perception of simple spatial forms of aggregates toward analysis, first by counting single unities, later, by recognition of small numbers as two or three and counting on the other unities in the group number. Still later these small groups may be combined by counting by twos, or by combining 'doubles', i.e. two and two; three and three, etc. Finally, a mature stage is reached, characterized by the prompt recognition and naming of aggregates as groups or cardinal numbers."

Regarding the portion of the test which dealt with the combining of aggregates of two or three numbers, the author states:

"Combining was a difficult test for all the children tested. Few three-year-olds had any understanding of the task. A few who attempted it employed counting methods. A year later





counting became the general procedure though a few of the four-year group recognized small aggregates from which they counted forward.

"Mature five-year-olds grouped the idea of augmentation more clearly as that of counting on from a familiar small number. A few counted forward by twos to a point of vantage and continued by ones to reach the sum sought. One or two children who knew a few simple combinations used these. The least mature children who continued the tallying methods of the younger years used such concrete methods as bobbing their heads, tapping with fingers or feet or the like. In some instances the use of tallies had become a deft skill not easily detected while in progress."

Deans<sup>1/</sup> points out the stages from counting to use of the number facts:

"Research has shown that counting does not necessarily lead the child to an understanding of the simple number facts. Instead he must master a whole series in learning before he can have adequate understanding of the number facts.....

"When children are able to manipulate groups with understanding and to recognize them readily, they are then ready to go one step beyond number experiences involving grouping and to begin to work toward an understanding of abstract numbers and the ability to use numbers in the abstract."

## Section 2

Number Facts:--Woody<sup>2/</sup> found:

"There was a great range in the knowledge of addition possessed by children in primary grades before formal instruction was introduced..... The children in the kindergarten manifested considerable knowledge of the easier combinations, some knowledge of the harder ones, and a little knowledge

<sup>1/</sup>Deans, Edwina. op. cit. p. 12

<sup>2/</sup>Woody, Clifford. op. cit. p. 188-201

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IN THE DEPARTMENT OF CHEMISTRY  
BY  
J. H. VAN VAN NEST  
PH.D.  
1924

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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of the exercises involving adding three one-place numbers and those involving a two-place number and a single-place number. In each of the successive grades an increasingly greater percentage of the pupils gave the correct responses to these types of exercises of the pupils gave the correct responses to these types of exercises of the pupils gave the correct responses to these types of exercises and to those types representing more difficult combinations and more complicated processes. The children in Grades 1A, 2B, and 2A ready for the introduction of formal study of arithmetic in the school year, possess, if their scores mean anything, a surprising amount of knowledge of the subject matter to which they will be exposed during their first year of systematized instruction."

Other evidence of school entrants' familiarity with number facts is offered by Buckingham and MacLatchy<sup>1/</sup>. In their Main Study the following percentages and facts are given of the 1356 children tested:

71.5	per	cent	responded	correctly	to	5	plus	1
63.9	"	"	"	"	"	7	plus	1
48.5	"	"	"	"	"	1	plus	9
36.9	"	"	"	"	"	4	plus	4
48.5	"	"	"	"	"	1	plus	6
43.8	"	"	"	"	"	5	plus	2
43.6	"	"	"	"	"	8	plus	2
21.8	"	"	"	"	"	4	plus	5
31.8	"	"	"	"	"	5	plus	3
26.9	"	"	"	"	"	3	plus	5

The above results are from a test in which the facts are put into verbal problems.

<sup>1/</sup>Buckingham, B. R. and MacLatchy, J. H. op. cit. p. 473-524

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's history and development. The author has done a great deal of research and has put together a very comprehensive and well-written report. The second part of the report deals with the specific details of the country's economy and society. It is a very detailed and thorough study of the country's current situation. The author has done a great deal of research and has put together a very comprehensive and well-written report.

Table 1: General Information			
Name	Age	Gender	Occupation
John Doe	30	Male	Teacher
Jane Smith	25	Female	Student
Bob Johnson	45	Male	Engineer
Alice Brown	35	Female	Doctor
Charlie White	50	Male	Lawyer
Diana Green	20	Female	Artist
Frank Black	60	Male	Retired
Grace Hall	40	Female	Nurse
Henry King	55	Male	Businessman
Ivy Lee	30	Female	Writer



The following results are found when the problems were given and concrete objects used to illustrate:

66.0	per cent	answered	2 plus 2
45.2	"	"	8 plus 1
50.7	"	"	6 plus 1
53.0	"	"	1 plus 7
63.9	"	"	3 plus 1
39.7	"	"	2 plus 4
37.1	"	"	2 plus 8
50.2	"	"	2 plus 6
32.6	"	"	3 plus 7
31.8	"	"	4 plus 6

Buckingham and MacLatchy<sup>1/</sup> list also the percentages received from the Cincinnati Study. Those achieving correct answers in verbal problems are

71.9	per cent	answered	5 plus 1
65.0	"	"	7 plus 1
53.2	"	"	1 plus 9
34.9	"	"	4 plus 4
50.8	"	"	1 plus 6
42.5	"	"	5 plus 2
43.3	"	"	8 plus 2
21.6	"	"	4 plus 5
34.2	"	"	5 plus 3
27.5	"	"	3 plus 5

---

<sup>1/</sup>Buckingham, B. R. and MacLatchy, J. H. op. cit. p. 473-524

TABLE I				
Summary of the results of the experiments				
Experiment	Time	Distance	Speed	Acceleration
1	10	100	10	1
2	20	200	20	2
3	30	300	30	3
4	40	400	40	4
5	50	500	50	5
6	60	600	60	6
7	70	700	70	7
8	80	800	80	8
9	90	900	90	9
10	100	1000	100	10
11	110	1100	110	11
12	120	1200	120	12
13	130	1300	130	13
14	140	1400	140	14
15	150	1500	150	15
16	160	1600	160	16
17	170	1700	170	17
18	180	1800	180	18
19	190	1900	190	19
20	200	2000	200	20
21	210	2100	210	21
22	220	2200	220	22
23	230	2300	230	23
24	240	2400	240	24
25	250	2500	250	25
26	260	2600	260	26
27	270	2700	270	27
28	280	2800	280	28
29	290	2900	290	29
30	300	3000	300	30
31	310	3100	310	31
32	320	3200	320	32
33	330	3300	330	33
34	340	3400	340	34
35	350	3500	350	35
36	360	3600	360	36
37	370	3700	370	37
38	380	3800	380	38
39	390	3900	390	39
40	400	4000	400	40
41	410	4100	410	41
42	420	4200	420	42
43	430	4300	430	43
44	440	4400	440	44
45	450	4500	450	45
46	460	4600	460	46
47	470	4700	470	47
48	480	4800	480	48
49	490	4900	490	49
50	500	5000	500	50
51	510	5100	510	51
52	520	5200	520	52
53	530	5300	530	53
54	540	5400	540	54
55	550	5500	550	55
56	560	5600	560	56
57	570	5700	570	57
58	580	5800	580	58
59	590	5900	590	59
60	600	6000	600	60
61	610	6100	610	61
62	620	6200	620	62
63	630	6300	630	63
64	640	6400	640	64
65	650	6500	650	65
66	660	6600	660	66
67	670	6700	670	67
68	680	6800	680	68
69	690	6900	690	69
70	700	7000	700	70
71	710	7100	710	71
72	720	7200	720	72
73	730	7300	730	73
74	740	7400	740	74
75	750	7500	750	75
76	760	7600	760	76
77	770	7700	770	77
78	780	7800	780	78
79	790	7900	790	79
80	800	8000	800	80
81	810	8100	810	81
82	820	8200	820	82
83	830	8300	830	83
84	840	8400	840	84
85	850	8500	850	85
86	860	8600	860	86
87	870	8700	870	87
88	880	8800	880	88
89	890	8900	890	89
90	900	9000	900	90
91	910	9100	910	91
92	920	9200	920	92
93	930	9300	930	93
94	940	9400	940	94
95	950	9500	950	95
96	960	9600	960	96
97	970	9700	970	97
98	980	9800	980	98
99	990	9900	990	99
100	1000	10000	1000	100

In problems with concrete objects used to illustrate:

70.1	per	cent	answered	2 plus 2
46.1	"	"	"	8 plus 1
54.5	"	"	"	6 plus 1
53.8	"	"	"	1 plus 7
70.5	"	"	"	3 plus 1
39.3	"	"	"	2 plus 4
36.0	"	"	"	2 plus 8
37.2	"	"	"	2 plus 6
27.4	"	"	"	3 plus 7
27.4	"	"	"	4 plus 6

In the Cleveland Study reported by Buckingham and Mac-Latchy<sup>1/</sup> the following per cents of the 313 children answered number facts in verbal problems:

36.4	per	cent	answered	8 plus 2
47.6	"	"	"	5 plus 1
30.1	"	"	"	7 plus 1
37.0	"	"	"	4 plus 4

In problems with concrete objects used to illustrate:

75.7	per	cent	answered	2 plus 2
46.6	"	"	"	1 plus 7
37.1	"	"	"	2 plus 4
27.2	"	"	"	2 plus 8
28.8	"	"	"	2 plus 6

<sup>1/</sup>Ibid. p. 473-524

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Fractions.--Polkinghorne<sup>1/</sup> says of young children and fractions:

"Children in the primary grades know a great deal more about fractions than is often imagined. A study which justified this statement was made with 266 children from the kindergarten, the first, the second, and the third grades of the Elementary School of the University of Chicago....."

The following are the results obtained in this study:

1. "These primary school children had certain concepts of fractions, as every child tested showed evidence of some knowledge of fractions.
2. "....It is seen that the children who took the tests understood unit fractions better than any other fractions included in the test; that these children knew something about proper fractions which are not unit fractions; that very few of the children knew anything about improper fractions; and about the identification of fractions; and that only one of these primary school children knew anything about equivalent fractions."

These tests demonstrated, too, that children knew much more about certain fractions than about others. From this study it was found that the children knew the fractions used in this study in this order:  $1/2$ ,  $1/4$ ,  $1/3$ ,  $3/4$ ,  $2/3$ ,  $4/3$ ,  $3/2$ ,  $3/5$ ,  $5/4$ ,  $2/5$ .

These tests also demonstrated:

a. That the children knew more about a unit fraction as applied to a single object than about any other of the fractions used in the test;  $1/2$  of 1, etc.

b. They knew a unit fraction when it was used in the

1/Polkinghorne, Ada R. "Young Children and Fractions." Child-  
hood Education, 11 (May, 1935) 354-358 Child-





comparison of two objects. "This is  $\frac{1}{2}$  as big as that," etc.

c. The children knew less about the unit fraction as applied to a group of objects than about the unit fraction applied to a single object. One-half of 1 is much easier than  $\frac{1}{2}$  of 4.

d. The children could use fractions in comparing two objects better than in comparing two groups of objects. "This is  $\frac{1}{2}$  of that" is easier than "3 is  $\frac{1}{2}$  of 6."

3....."It is seen that the group of four- to six-year-olds had some concepts of unit reactions; that some of the children began to understand proper fractions other than unit fractions between the sixth and eighth years; that these children began to identify fractions between the eighth and tenth years; and that they were almost wholly ignorant of the concept of equivalent fractions.

Woody<sup>1/</sup> points out that from findings on tests involving 94 kindergarten, 604 Grade IB, and 1897 Grade IA children there is evidence that children of this level have some familiarity with fractions,  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and 14. This author states:

"Approximately two-thirds of the children in kindergarten and Grade IB, three-fourths in Grade IA and 2B, and nine-tenths in Grade 2A selected from the set of pictures of apples cut into various fractional parts, the one which showed the apple cut into halves. Almost half of the children in the Kindergarten and in Grade IA, and slightly over two-thirds of the children in the other grades under consideration were able to select the apples cut into fourths and thirds. The percentages of children responding correctly to the questions involving knowledge of the number of halves, thirds, or fourths into which an apple has been cut was considerably less than the percentage responding to the exercises involving

<sup>1/</sup> Woody, Clifford. op. cit. p. 188-201



the designation of apples cut into enumerated fractional parts. The responses to exercises involving the relative size of the fractions indicate that a very large proportion of the children knew that a whole apple is larger than half an apple; approximately half of them knew that half of an apple is larger than a fourth of an apple. A considerably smaller proportion of the children responded correctly to the exercises involving half and third, fourth, and third, and half, third, and fourth, but the percentage making correct responses indicates some understanding of these fractions."

Wittich<sup>1/</sup> reports that of the 76 first grade children he tested:

".....Almost all of the children understand the concept of the fraction one-half. Apparently the fractions one-third and one-fourth represent greater difficulty. In almost every case, as indicated in the reactions to the test, the child did know that both one-third and one-fourth are less than one-half. This in itself indicates receptivity to the fraction concept in general, even among first-grade children."

Miscellaneous:--Woody<sup>2/</sup> states as results of his testing the arithmetical backgrounds of young children that:

".....the knowledge possessed by children is not limited to counting and adding simple combinations, but includes elementary knowledge of fractions, United States money, units of various types of measurement, and the understanding of the processes demanded in simple verbal problems."

In this author's test the children were not only required to read the time as seen in drawings of clock faces but also to place the hands on the clock faces to show the time of day as given by the person testing. Following are two of the outcomes:

1/Wittich, Walter A. op. cit. p. 11-13

2/Woody, Clifford. op. cit. p. 188-201





"(1) the mean percentage of correct responses on all of the exercises for the children in the Kindergarten and Grade IB was approximately 25 per cent.....(2) the exercises involving the reading of the time were considerably easier than those in which the placing of the minute hand to indicate a given time was required."

Smith<sup>1/</sup> investigated the use which children make of arithmetic outside the classroom. Through personal interview of 500 first grade children it was found that:

"30 per cent of the occasions occurred in transactions carried on in stores, 18 per cent on the clock and 13 per cent in reading Arabic numerals in finding pages in books.

"In tabulating the frequency of the arithmetical operations used by the pupils in solving problems, it was found that the percentages of the total for the four most frequent operations were as follows: addition, 35 per cent; counting, 23 per cent; subtraction, 12 per cent; and fractions, 8 per cent.

"Since the use of fractions is not commonly considered an appropriate topic for first grade study, some readers may be surprised to find it occurring fourth in frequency. A very large proportion of the situations involving fractions were those in which the children divided candy or food with playmates or pets. The amounts were confined almost entirely to halves, quarters, and thirds."

Stotlar<sup>2/</sup> testing pre-school children on ability to write numbers finds:

".....when asked to write numbers, all the children were definitely conscious that there was such a thing as written numbers, and all but one made an attempt at writing. Five (26 per cent) successfully completed the task."

<sup>1/</sup> Smith, Nila B. "An Investigation of the Uses of Arithmetic in the Out-Of-School Life of First-Grade Children." Elementary School Journal 24 (April, 1924) p. 621-626

<sup>2/</sup> Stotlar, Carolyn op. cit. p. 344



Research has shown children entering Grade One differ in arithmetical backgrounds. Therefore, the purpose of this study is to evaluate three types of programs for arithmetic in Grade One.



## CHAPTER II

### PLAN OF THE STUDY

#### Restatement of the Problem

The purpose of this experiment was to evaluate three types of arithmetic programs in Grade One. Three first grades in the public school system of Quincy, Massachusetts, were selected. One plan was used in each of the three grades and the results tabulated for each program. The first program was an incidental program. In the second program a commercial number workbook was used. The third program is one planned by the writer and makes use of concrete and semi-concrete materials in the development of number activities.

#### Descriptions of the Three Programs

##### Program I - The Incidental Program

This incidental method is not correctly termed a program. There are no planned situations in this method. When and if number situations arise they may be used. In the course of a day in a first grade many opportunities arise in which numbers and their uses may be explained. These opportunities may be used if the teacher so desires, if time permits, and if the children are correctly disposed.

This incidental approach was used with the first group





included in this experiment. As the foregoing description implies, no definite time was allotted for arithmetic in this first group.

Program II- The Program in which the Commercial Number Workbook was used.

In the second program to be evaluated the children used a number workbook, "My First Number Book."<sup>1/</sup> This workbook is chosen because it is the preprimer of number in the arithmetic series by Clark, Otis, and Hatton, which series is used in the school where the experiment was conducted.

The purpose of "My First Number Book" is to provide planned practice to fulfill these objectives listed by the authors:

- (1) "To know the sequence of numbers from 1 to 10.
- (2) "To read and write the numbers from 1 to 10.
- (3) "To recognize the elementary composition and relationships of numbers from 1 to 10; for example, that a group of 5 is composed of groups of 3 and 2 or groups of 4 and 1.
- (4) "To count objects (1 to 10) and write the number.
- (5) "To number objects serially.
- (6) "To use understandingly a simple vocabulary of number relations, such as big, little, more, short, long, take away, count, number, etc.
- (7) "To recognize the processes of addition and subtraction in simple concrete situations and to discover the answer with the help of pictures or objects."

<sup>1/</sup>Clark, John R., Otis, Arthur S., and Clark, Caroline Hatton. My First Number Book. World Book Co., Yonkers-On-Hudson, New York, 1945.

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During the second semester, beginning February 7, 1949, the second group in this experiment began work in this number workbook. During a 15-minute period each day for fifteen weeks the children who used the number workbook worked as one group on material in the book.

Program III - The Planned Program in which concrete and semi-concrete materials were used.

This program, planned and taught by the writer, has the same objectives as those listed for the workbook of Program II. The lessons in this program parallel those in the workbook. The workbook provides pictures on the printed page. The lessons in the planned program require concrete materials to be manipulated by the children. Where the workbook uses pictures of objects, the planned program requires actual objects to be seen and handled by the children.

The concrete materials:--To carry out the planned program it was necessary to provide each child with concrete materials. To hold these materials each child was provided with an empty cigar box. Into each cigar box were put the following concrete materials:

- 25 acorns
- 25 pumpkin seeds
- 25 beans
- 25 colored pegs
- 20 toothpicks
- 10 small colored blocks

...the ...  
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10 buttons

10 pipe cleaners (5 blue and 5 pink)

10 one inch squares of colored paper

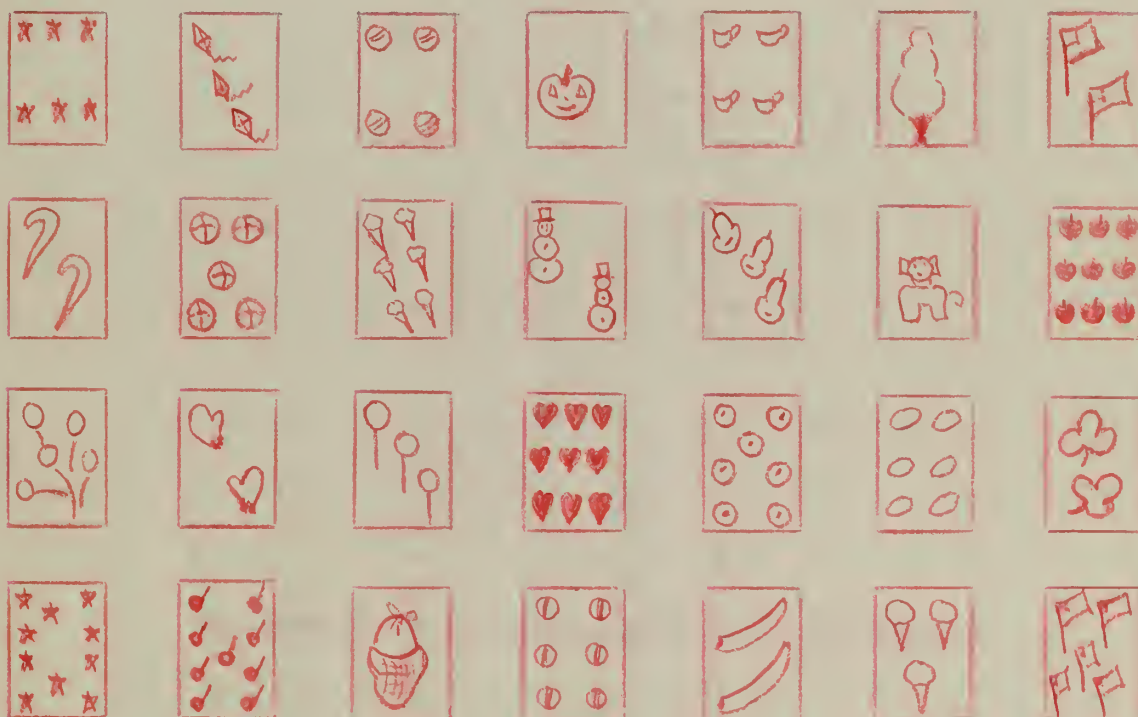
10 circles cut from colored paper

10 semi-circles cut from colored paper

10 small triangles cut from colored paper











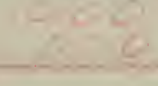



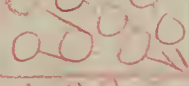

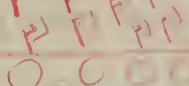



10 oblongs cut from colored paper

The semi-concrete materials:--The following are diagrams of oak tag number cards, 9" x 12" made by pasting cutout colored paper objects on the cards:





As each number was introduced it was added to this chart.

1			one
2			two
3			three
4			four
5			five
6			
7			
8			
9			
10			



As closely as possible the lessons in the planned program followed the development of material in the commercial number workbook. In this way there was no added practice for those in the planned program. If three pages in the workbook were devoted to work on the number 6, for example, then three lessons in the planned program were presented to develop the number 6 through the use of concrete and semi-concrete materials.

As each number was introduced it was added to a class number chart at the front of the room. On this chart were these items arranged horizontally:

1. The arabic numeral
2. A picture of one or more than one object showing the value of the number
3. Semi-concrete materials, such as dots, to show the value of the number
4. The number name in some cases. Only the names of the numbers one to five were taught since these were the only ones used in the reading program throughout the year.

Inventory taken before instruction:--Before a number was presented inventory was taken. This consisted of discussion of what was known about the number from past experience. The children were asked what the given number meant to them. When the number 6 was to be studied the





teacher asked the questions, "What does six mean? When I say six, what do you think of?" The following were a few of the responses listed; 6 o'clock, 6 years old, 6 grades in school, 6 absent, 6 toys, 6 hundred, 6 balls.

Introduction of the number and use of concrete and semi-concrete materials:--When the children had told what the new number meant to them work was begun with concrete materials. Objects in the number boxes were used to count. If the number six were being introduced, blocks up to six were taken by each child and placed on his desk. Then work was done in grouping these objects. When three blocks were put in one place and three in another it could be seen that six was composed of two groups of three. If two blocks were placed at the top of the desk and four at the bottom it could be seen that six also had two groups made up of two and four, and so forth. By the time in the program that number six was introduced the children were sufficiently advanced to stand to tell what groups were in the number. For example, one child told, "I have five blue blocks and one red block. All together I have six blocks in this row." When this was told, the fact was illustrated on the blackboard with drawings of five blocks under which was written the number 5 and then one block drawn apart with the number 1 under it. The other children counted likewise to see that the five blocks and the one block made a total of six. Other groups were illustrated in a similar manner.



Work with semi-concrete material consisted of counting objects illustrated with colored paper on 9" x 12" oak tag cards. When these were placed within sight of the children comparisons were made. As directed, the children indicated the card having the most number of objects or found the card which had more than a given number, or located two cards which had the same number of objects.

Writing the number:--Following the lesson when the new number was introduced and added to the class number chart the children were taught how to write the number. The teacher wrote the number on the blackboard, the children traced the number in the air and then on paper they traced the number which had been written by the teacher. After tracing the teacher's number, each child went on to make the same number in the remaining spaces marked off on the paper. While this was being done the teacher observed each child to ascertain correct formation of the new number.

Review of numbers previously taught:--When a new number was presented and the children taught how to write it the lessons which followed this were lessons to review the numbers previously taught. The number of these review lessons were determined by the work in the number book. Whatever material was reviewed in the number book was also reviewed in the planned program and in the same number of lessons.

This review work was done in different ways. In some lessons directions were written on the blackboard and the





children followed these, drawing objects and numbering them or illustrating addition or subtraction facts. Other lessons required the use of rulers to give meaning to the terms longer and shortest as well as inches. In some instances arithmetic and art were correlated and pinwheels were constructed, a vase of paper pussywillows made, or designs developed, using the terms, circle, triangle, square, semi-circle, and oblong.

Work in addition:--Following the review lessons work was done in addition. In the numberbook the addition facts were presented with pictures of objects. Under these pictures the number facts were written, such as, 2 balls and 4 balls are \_\_\_\_\_ balls. The children were instructed to write the missing number in the space. To parallel this in the planned program the children were instructed to place before them two blocks. When the two blocks had been put at the top of a practice paper the children were told to write the number 2. Near the two blocks at the top edge of the paper were next put four more blocks. When all the blocks were placed the children counted to see that there were six blocks. Attention was then directed to the number 2 which had been written on the paper and the remainder of the fact was written, 2 and 4 are 6. As described in the lessons in Appendix A, the facts were presented in this form,  $2 + 4 = 6$ , in a lesson which followed the one in which it was written 2 and 4 are 6.

Work in subtraction:--Work in subtraction followed work in addition, as was the procedure in the workbook. This was the

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part outlines the specific procedures for recording and reporting data. It details the steps involved in data collection, analysis, and the frequency of reporting to the relevant stakeholders.

3. The third part addresses the challenges associated with data management and provides strategies to overcome them. It highlights the need for robust security measures to protect sensitive information from unauthorized access.

4. The fourth part discusses the role of technology in enhancing data management processes. It explores various software solutions and tools that can streamline data collection, storage, and analysis, thereby improving efficiency and accuracy.

5. The fifth part concludes by summarizing the key findings and recommendations. It reiterates the importance of a systematic approach to data management and encourages continuous improvement in the organization's data practices.

form used in the workbook:

I see \_\_\_\_\_ stars.      \*\*\*

\*\*\*

Take away 2 stars.

\_\_\_\_\_ stars are left.

The children crossed out two stars, counted the number left, and wrote the number to complete the last sentence.

The following was the method used in the planned program: The children were instructed to place six beans at the top edge of a practice paper. When this was done the number 6 was written on the paper. In the next step the children took away two beans and counted to see how many beans were left. Then this was written, 6 take away 2 leaves 4. In the next lesson in subtraction the fact was written 6 - 2 = 4 after the explanation of the symbol for subtraction had been given.

Reproducing the facts with drawings:--After use of the concrete materials, and when the addition or subtraction facts had been written on the practice paper, the children made drawings of these facts in the spaces left on the paper, as

$$2 \neq 4 = 6$$

\*    \*\*

\*    \*\*

The foregoing was the program planned by the writer to use concrete and semi-concrete materials in the teaching of arithmetic in Grade One. Each lesson in the planned program was taught during a fifteen minute period each day for fifteen



weeks from February seventh to June third, 1949.

Each of the three programs described was taught in one of three first grades in the City of Quincy, Massachusetts. In this city formal arithmetic is not presented until the second grade. No time is allotted in the first grade for the teaching of arithmetic other than incidentally. However, for purposes of this experiment arithmetic was taught in two first grades for fifteen minutes a day for fifteen weeks as stated above. One of these first grades used the commercial workbook while the other was taught by the lessons in the planned program. These first grades were in the same building. In another building in the same district a first grade continued to teach arithmetic throughout the year by the incidental method. In the two grades where the formal programs were carried out the incidental method was used up until the beginning of the experiment. The writer taught the lessons in the planned program but the other programs were carried out by the teachers of the other two first grades selected.

Selection of the population:--Included in this experiment were 78 children. There were 26 in each of the groups taught. There were more children in each of the first grades selected but those repeating Grade I were eliminated. In the City of Quincy there are no public kindergartens so that the children had received no formal training in arithmetic under a kindergarten program. The groups had comparable social and economic backgrounds.



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Mental ages were determined in May, 1949, when the Pintner-Cunningham Primary test: Form B<sup>1</sup>/<sub>1</sub> was given by each of the classroom teachers.

Table I shows the mean chronological and mental ages for each group.

Table 1

Mean Chronological and Mental Ages in Months

Group	Number	Mean	S.D.	Mean	S.D.
		C.A.		M.A.	
Incidental	26	80.05	4.74	84.74	12.36
Workbook	26	79.45	3.69	91.14	7.77
Planned	26	79.62	3.92	83.93	8.88

The mean chronological age was 80.05 for those in the incidental program, 79.45 in the workbook program, and 79.62 in the planned program. The mean mental age for those in the incidental program was 84.74, in the workbook program 91.14, and in the planned program, 83.93.

The testing program:--To evaluate these programs an arithmetic readiness test was constructed. The items included were done so in view of the facts revealed in previous research in the field of arithmetic readiness.

The test was in booklet form and consisted of sixteen pages. The pages were not numbered in case the numbers would be clues in the answering of some items. Following are the lettered pages and the areas tested by the items on that page:

1/Pintner-Cunningham Primary Test: Form B. World Book Co.  
Yonkers-on-Hudson, New York, 1946



Page A--Three items testing the ability to appreciate that groups of objects may differ in size or amount. These items call for marking of the man with the most balloons, the glass with the most milk, and the bowl with the most fish.

Page B--Four items testing the power to identify the following numbers: three, one, five, and two. On this page the pictures to be marked are the three little pigs, the box with one ball, the cake with five candles, and the picture with two kittens.

Page C--Five items testing knowledge of the ordinals; third, second, fifth, fourth, first. Pictures of animals and birds are arranged horizontally in rows. In each row one item is marked as directed; the third horse, the second dog, the fifth duck, the fourth bird, and the first bunny.

Page D--Four items testing ability to identify the following: a circle, a square, a triangle, a semi-circle.

Page E--Five items testing knowledge of these terms of comparison; biggest, largest, smallest, longest. Pictures of animals and toys are arranged horizontally in rows and the following are marked; the biggest pumpkin, the largest cat, the biggest pig, the smallest owl, and the longest car.

Page F--Three items testing knowledge of the following terms so often used in school: row, middle, partner. Directions require the marking of the following pictures: the middle house, the soldiers in a row, the girls who are partners.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part outlines the various methods used to collect and analyze data, including surveys, interviews, and focus groups. It also discusses the challenges associated with data collection and analysis.

3. The third part presents the results of the study, showing the trends and patterns in the data. It includes tables and graphs to illustrate the findings.

4. The fourth part discusses the implications of the study for policy and practice. It suggests ways in which the findings can be used to improve the effectiveness of the program.

5. The fifth part concludes the document by summarizing the key points and providing a final statement on the importance of the study.



Page G--Five items testing the following terms: alone, around, different, highest, lowest. The pictures marked are the star with the circle around it, the horse standing alone, the fish that is different, the plane up highest, the lowest witch.

Page H--Three items testing knowledge of the terms under, bottom, top. To be marked on this page are the bottom shelf, the top of the tree and a place under the pony.

Page I--Three items testing ability to tell time. One of three clocks in each of three rows is identified according to directions to mark the clock that says 8 o'clock, the clock that says 5 o'clock, and the clock that says 11 o'clock.

Page J--Three items testing the ability to reproduce a given number in a given position. Directions are followed to put three marks at the top, one mark at the bottom, and two marks in the middle.

Page K--Four items testing the ability to compare and find the same number of lines, to reproduce the same number of lines to interpret the term enough, to reproduce the number eight and the number six. On this page in the first row the items to be marked are the balls with the same number of lines, in the second row an empty box is to be furnished with the same number of lines as the picture box, in the third and fourth rows enough sticks for eight lollipops are to be marked and enough pieces of paper for six children.

Page L--Three items testing knowledge of fractions and



the term each. The items to be marked are the orange cut in half, how many each ate, and the sandwich cut in quarters.

Page M--Four items testing the ability to enumerate and then write the given number. Objects to be counted and the corresponding number written are nine sticks, seven sticks, ten dots, and four dots.

Page N--Five items testing recognition of and the ability to reproduce the written numbers 2, 6, 3, 12, and 20.

Page O--Five items testing the ability to solve problems involving the number facts four plus one, three plus one, four plus three, five plus five, and three plus two.

Page P--Five items testing the ability to solve problems involving the number facts five minus two, three minus two, five plus four, eight minus two, and six minus four.

A complete copy of the test with directions for administering and scoring may be found in Appendix B.

This test was administered during the second week of school in September before any arithmetic program was started. At the end of the experiment, June 3, 1949, the test was again administered to each group and the scores tabulated.



### CHAPTER III

#### ANALYSIS OF DATA

The data were analyzed to study the effect of the three programs in Grade One.

The following comparisons were studied:

1. The results of the preliminary and final tests in the incidental and planned programs.
2. The results of the preliminary and final tests in the workbook and planned program.
3. The results of the preliminary and final tests in the incidental and workbook program.
4. Sex differences in achievement in the incidental program.
5. Sex differences in achievement in the workbook program.
6. Sex differences in achievement in the planned program.





Table 2  
Results of the Preliminary and Final Tests  
in  
The Incidental and Planned Programs

Test	Program	Number	Mean	S.D.	S.E. Mean	Diff. Mean	S.E. Diff.	Critical Ratio
I	Incidental	26	39.43	8.07	1.58			
I	Planned	26	42.95	6.09	1.19	3.52	1.98	1.78
II	Incidental	26	56.14	4.85	0.95			
II	Planned	26	57.86	2.56	0.50	1.72	1.06	1.61
Initial Diff.		S.E.	Final Diff.	S.E.	Gain	S.E.	Critical	
Mean Score		Diff.	Mean Score	Diff.		Gain	Ratio	
3.52		1.98	1.72	1.06	1.80	2.24	0.80	

The mean score obtained in the Planned Program was 42.95 compared with 39.43 in the Incidental Program, in the preliminary test. The critical ratio was 1.78, showing the difference to be not statistically significant.

The mean score of the Planned Program was 57.86 compared with 56.14 in the Incidental Program. The critical ratio was 1.61, showing the difference to be not statistically significant.

In the preliminary test the scores of the students in the Planned Program were higher than those in the Incidental Program. To eliminate this advantage, the difference of the two means was found and the standard error of this gain computed. The critical ratio was not significant. The chances are 56 in 100 that this is a true difference.

Table three shows the results of the preliminary and final arithmetic readiness tests in the workbook and planned programs.

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Table 3

Results of the Preliminary and Final Tests  
in  
The Workbook and Planned Programs

Test	Program	Number	Mean	S.D.	S.E. Mean	Diff. Mean	S.E. Diff.	Critical Ratio
I	Workbook	26	47.81	5.01	0.98			
I	Planned	26	42.95	6.09	1.19	4.86	1.54	3.15
II	Workbook	26	58.57	1.16	0.23			
II	Planned	26	57.86	2.56	0.50	0.71	0.55	1.29

The mean score obtained in the workbook program was 47.81 compared with 42.95 in the planned program in the preliminary test. The critical ratio was 3.15, showing a significant statistical difference in favor of the children in the workbook program.

The mean score in the workbook program in the final test was 58.57 compared with 57.86 in the planned program. The critical ratio was 1.29, showing the difference to be not statistically significant. The chances are 80 in 100 that this is a true difference.

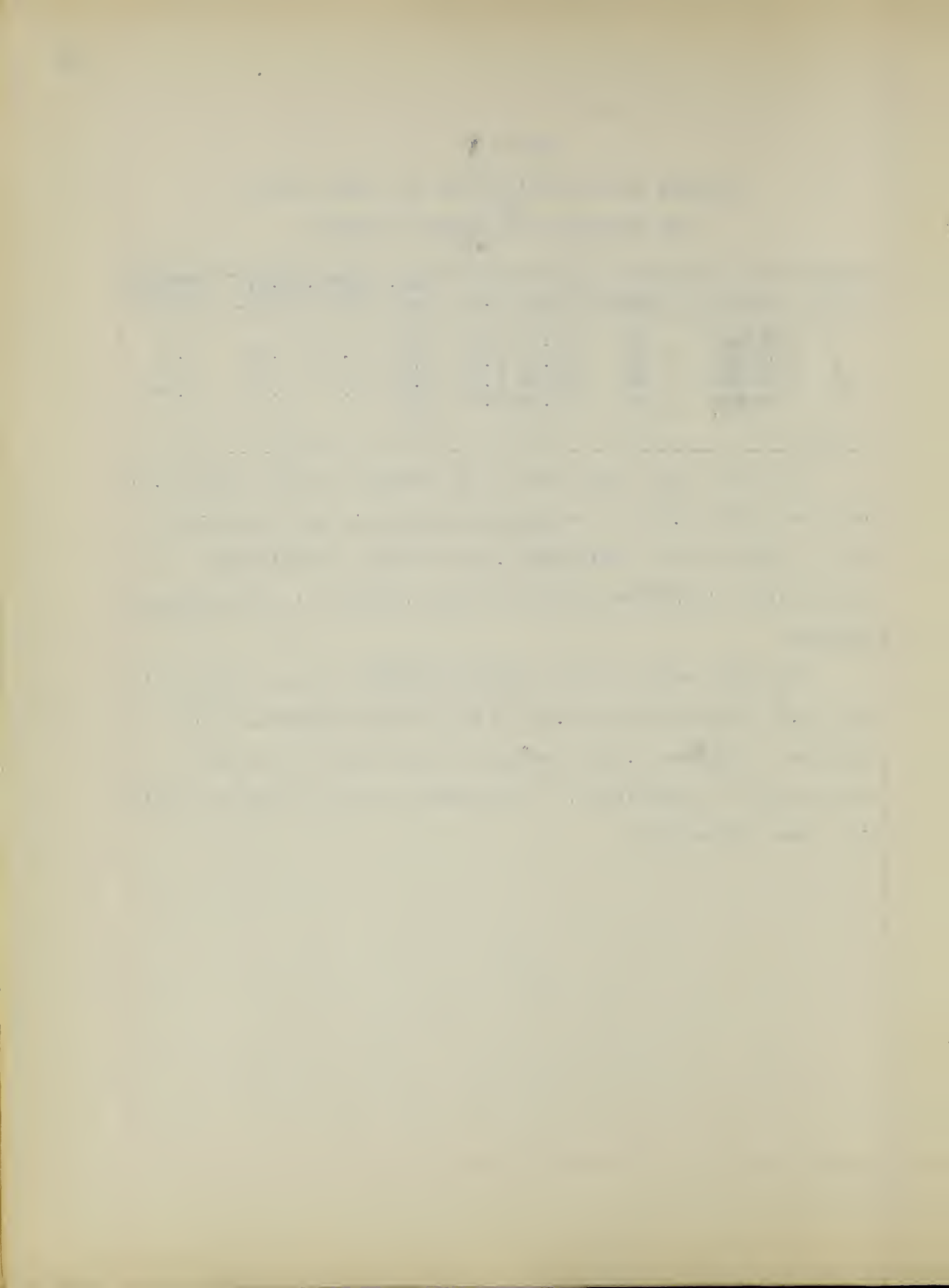




Table four shows the results of the preliminary and final arithmetic readiness tests in the incidental and workbook programs.

Table 4  
Results of the Preliminary and Final Tests  
in  
The Incidental and Workbook Programs

Test	Program	Number	Mean	S.D.	S.E. Mean	Diff. Mean	S.E. Diff.	Critical Ratio
I	Workbook	26	47.81	5.01	0.98	8.38	1.86	4.51
I	Incidental	26	39.43	8.07	1.58			
II	Workbook	26	58.57	1.16	0.23	2.43	0.97	2.52
II	Incidental	26	56.14	4.85	0.95			

The mean score obtained in the workbook program was 47.81 compared with 39.43 in the incidental program in the preliminary test. The critical ratio was 4.51, showing a significant difference in favor of the workbook.

The mean score obtained in the workbook program was 58.57 compared with 56.14 obtained in the incidental program. The critical ratio was 2.52, not a significant difference. The chances are 98 in 100 that this is a true difference.



Table five shows the differences in achievement in the final arithmetic readiness test in the incidental program.

Table 5

Sex Differences in Achievement  
Incidental Program

	Number	Mean	S.D.	S.E. Mean	Diff. Mean	S.E. Diff.	Critical Ratio
Boys	14	56.50	4.61	1.26	0.74	1.87	0.39
Girls	12	55.76	4.79	1.38			

The mean score obtained by the boys was 58.50 compared with 55.76 obtained by the girls. The critical ration was 0.39 showing the difference to be not statistically significant. The chances are 30 in 100 that this is a true difference.

Table six shows the difference in achievement in the final arithmetic readiness test in the workbook program.

Table 6

Sex differences in Achievement  
Workbook Program

	Number	Mean	S.D.	S.E. Mean	Diff. Mean	S.E. Diff.	Critical Ratio
Boys	14	58.79	1.37	0.37	0.55	0.41	1.34
Girls	12	58.24	1.94	0.56			

The mean score obtained by the boys was 58.79 compared with 58.24 obtained by the girls. The critical ratio was 1.34



showing the difference to be not significant. The chances are 80 in 100 that this is a true difference.

Table seven shows the difference in achievement in the final arithmetic readiness test in the planned program.

Table 7  
Sex Differences in Achievement  
Planned Program

	Number	Mean	S.D.	S.E. Mean	Diff. Mean	S.E. Diff.	Critical Ratio
Boys	15	59.39	0.76	0.19	2.58	1.09	2.36
Girls	11	56.81	0.91	0.27			

The mean score obtained by the boys was 59.39 compared with the score 56.81 obtained by the girls. The critical ratio was 2.36 which is not significant. The chances are 98 in 100 that this is a true difference.





## CHAPTER IV

### SUMMARY AND CONCLUSIONS

The purpose of this study was to evaluate three programs for teaching arithmetic in Grade One. In the first program the incidental approach was used to develop number concepts. In the second program a commercial workbook was used. The third program was planned by the writer to use concrete and semi-concrete materials in the development of number concepts. The experiment was conducted in an industrial city in Massachusetts. There were 26 children in each of the groups included in the study. Only one program was used for each group. An original arithmetic readiness test was given to each group before beginning and at the close of the experiment. Mental ages were obtained by the Pintner-Cunningham Primary Test: Form B.<sup>1/</sup>

#### Conclusions

1. The final score obtained on the arithmetic readiness test at the close of the year showed little difference in the results of the three programs. The mean score on the test for the incidental program was 56.14. For the planned program the mean score was 57.86. For the workbook program the final mean score was 58.57.

<sup>1/</sup>Pintner-Cunningham Primary Test: Form B. World Book Co. Yonkers-On-Hudson, New York, 1946

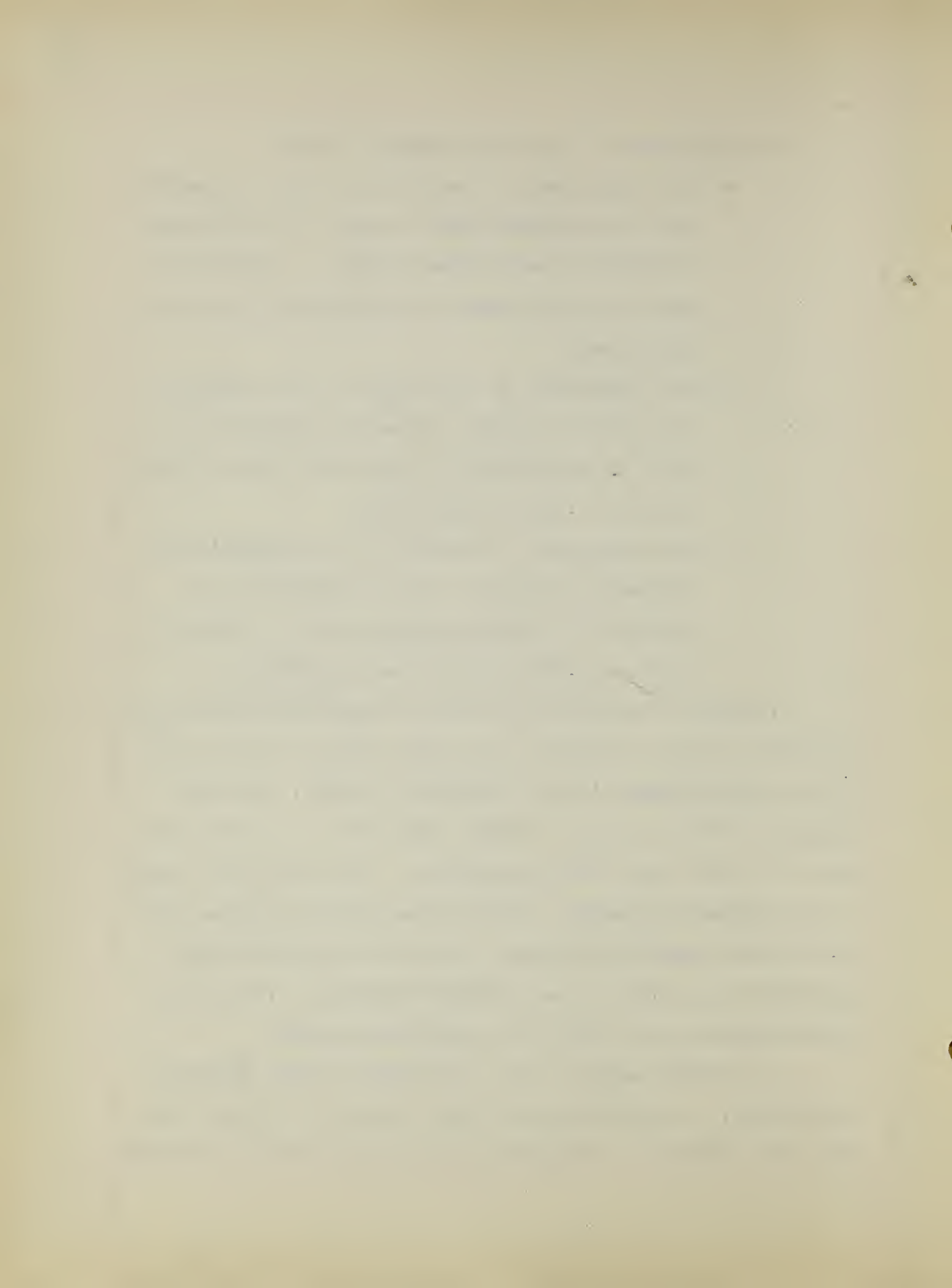


2. Comparisons of the three programs follow:

- a. The comparison of the results of the incidental with the planned program showed the difference in favor of the planned program. The critical ratio of 0.80 showed the difference to be not significant.
- b. The comparison of the results of the workbook and planned programs showed the difference in favor of the workbook program with the critical ratio of 1.29 not significant.
- c. The comparison of results of the workbook and incidental programs show the difference in favor of the workbook program with a critical ratio of 2.52 which was not significant.

3. While the differences were not significant there was a narrower range of scores on the final scores in each of the planned programs than in the incidental program. The preliminary tests had larger standard deviations. In the final tests the means were fairly comparable. The means were 56.14 in the incidental program, 57.86 in the planned program, and 58.57 in the workbook program. The corresponding standard deviations were 4.85 in the incidental program, 2.56 in the planned program, and 1.16 in the workbook program.

4. It would seem that the boys improve under definite instruction. A sex-difference study showed in each case the boys were superior to the girls. None of the differences were





significant, however. In the incidental program the critical ratio was 0.39, in the workbook program the critical ratio was 1.34, and in the planned program the critical ratio was s.36.

Suggestions for Further Research

1. Conduct the experiment using larger and equated groups.
2. As the experiment progresses, describe the number experiences carried out in the incidental program.
3. Refine the readiness test.



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APPENDIX A  
LESSON PLANS OF THE PLANNED PROGRAM



## Lesson 1

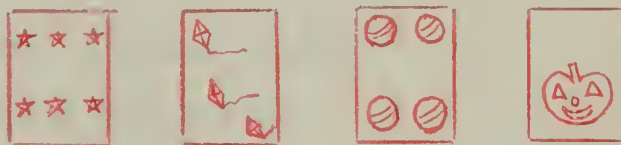
### Aim:

To proceed from what is known about the number 1 to systematic instruction in meaning of the number 1 by means of concrete and semi-concrete materials.

### Material:

Materials in number boxes.

Oak tag cards 9" x 12" on which are pasted colored paper objects as indicated in diagram.



### Procedure:

The teacher asks, "What do you think of when I say one? What does one mean to you?"

(These were the answers obtained as individuals answered. Each answer was recorded as it was given.)

one chair

one paper

one horse

one pony

one can

one top

one apple

a number

one dollar

one house



one dime

one quarter

one "fifty cents"

one "half dollar

one penny

one dollar

At conclusion of the above inventory the teacher calls attention to objects and to the material on cards in sight of all the children.

"How many flags can you find in this room?"

"How many telephones are in this room?"

"How many teachers do you see here?"

"How many waste baskets do we use in this room?"

Individuals indicate one of each of the above, there being only one of each item to be found in the room.

The teacher calls attention to the number cards.

"What do you see on these cards? Who can find the card with one thing on it?"

"Look at your hands. Hold up one finger. Show me your nose. How many do you have? Put ~~one~~<sup>up</sup> one foot. Show one finger on your other hand."

After the children have followed the direction to take from their desks their number boxes the following work is done with the concrete materials taken from the boxes.

"Pick out one peg. Put it at the left and at the top of the desk like this." (Demonstrate).









Lesson 2Aim:

To teach the correct formation of the number one.

To begin a chart showing articles which may be bought for one cent.

Materials:

Arithmetic paper folded in fourths with the number 1 made by the teacher as in diagram.



Oak tag 12" x 18" on which has been mounted a penny post-card and one piece of candy bought for one cent.

Procedure:

"Today we shall learn to write the number 1. Who can find the number 1 which was put on the number chart yesterday? Yes, that is the number one. That is the way it is made." (Teacher demonstrates at the blackboard indicating the starting point).

"See if you can sky-write this number. This is the way to sky-write the number 1." (Teacher demonstrates, writing the number 1 in the air).

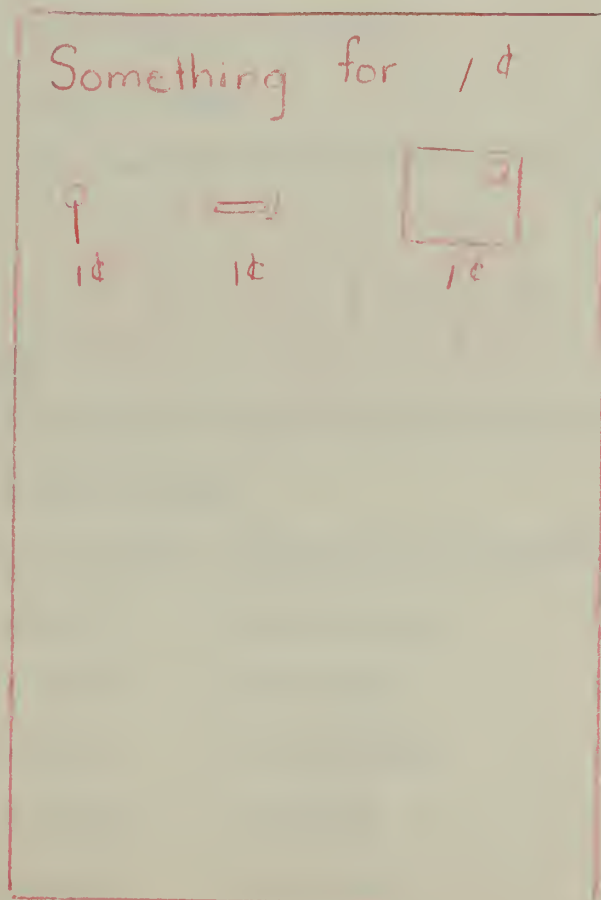
"Here is a paper with the number one written here. Trace this number like this. (Indicate 1 and trace it so all may see). After you trace this one make another number 1 here (indicate second box on paper) and another 1 here, and another 1 here."





When these papers have been corrected, as the teacher passes each desk to check, attention is called to the chart as labelled.

After the teacher reads aloud the title of the chart she says, "This piece of candy costs one cent. This card costs 1¢. Can you tell something else you buy for one cent? If you bring something to put on this chart it must cost one cent. I can pay you one cent for each thing you bring, but it must cost only one cent."



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Lesson 3Aim:

To proceed from what is known about the number two to systematic instruction in the meaning of number two through use of concrete and semi-concrete material.

Materials:

Objects to be used in answer to questions in the lesson are put in twos around the room as:

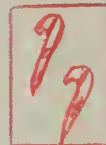
two large chairs

two plants in the window

two books on a table

number boxes

oak tag cards 9" x 12" as in diagram

Procedure:

Teacher asks, "What do you think of when I say two?  
What does two mean to you?"

These were the responses as recorded when given.

two nails	two windows	two toys
two boats	two flags	two blackboards
two cents	two monkeys	two trees
two nickels	two days	two houses
two things	two ducks	two lollipops
two birds	two dolls	two balls
two chairs	two farms	two pieces of gum

The first of these is the fact that the  
 Government has been unable to secure  
 the necessary funds to carry out its  
 policy of non-interference.

The second is the fact that the  
 Government has been unable to secure  
 the necessary funds to carry out its  
 policy of non-interference.

TABLE I

Summary of the results of the survey of the  
 conditions of the various districts of the  
 country.

District	Population	Area	Resources
North	1,000,000	10,000 sq. miles	Rich in minerals
South	2,000,000	20,000 sq. miles	Rich in minerals
East	3,000,000	30,000 sq. miles	Rich in minerals
West	4,000,000	40,000 sq. miles	Rich in minerals
Central	5,000,000	50,000 sq. miles	Rich in minerals
North-East	6,000,000	60,000 sq. miles	Rich in minerals
South-East	7,000,000	70,000 sq. miles	Rich in minerals
North-West	8,000,000	80,000 sq. miles	Rich in minerals
South-West	9,000,000	90,000 sq. miles	Rich in minerals
Central-East	10,000,000	100,000 sq. miles	Rich in minerals
Central-West	11,000,000	110,000 sq. miles	Rich in minerals
Central-South	12,000,000	120,000 sq. miles	Rich in minerals
Central-North	13,000,000	130,000 sq. miles	Rich in minerals
Central-East-South	14,000,000	140,000 sq. miles	Rich in minerals
Central-East-North	15,000,000	150,000 sq. miles	Rich in minerals
Central-South-East	16,000,000	160,000 sq. miles	Rich in minerals
Central-South-West	17,000,000	170,000 sq. miles	Rich in minerals
Central-North-East	18,000,000	180,000 sq. miles	Rich in minerals
Central-North-West	19,000,000	190,000 sq. miles	Rich in minerals
Central-East-South-West	20,000,000	200,000 sq. miles	Rich in minerals
Central-East-North-East	21,000,000	210,000 sq. miles	Rich in minerals
Central-South-East-North	22,000,000	220,000 sq. miles	Rich in minerals
Central-South-West-North	23,000,000	230,000 sq. miles	Rich in minerals
Central-North-East-South	24,000,000	240,000 sq. miles	Rich in minerals
Central-North-West-South	25,000,000	250,000 sq. miles	Rich in minerals
Central-East-South-North	26,000,000	260,000 sq. miles	Rich in minerals
Central-East-North-South	27,000,000	270,000 sq. miles	Rich in minerals
Central-South-East-North	28,000,000	280,000 sq. miles	Rich in minerals
Central-South-West-North	29,000,000	290,000 sq. miles	Rich in minerals
Central-North-East-South	30,000,000	300,000 sq. miles	Rich in minerals
Central-North-West-South	31,000,000	310,000 sq. miles	Rich in minerals
Central-East-South-West	32,000,000	320,000 sq. miles	Rich in minerals
Central-East-North-West	33,000,000	330,000 sq. miles	Rich in minerals
Central-South-East-North	34,000,000	340,000 sq. miles	Rich in minerals
Central-South-West-North	35,000,000	350,000 sq. miles	Rich in minerals
Central-North-East-South	36,000,000	360,000 sq. miles	Rich in minerals
Central-North-West-South	37,000,000	370,000 sq. miles	Rich in minerals
Central-East-South-North	38,000,000	380,000 sq. miles	Rich in minerals
Central-East-North-South	39,000,000	390,000 sq. miles	Rich in minerals
Central-South-East-North	40,000,000	400,000 sq. miles	Rich in minerals
Central-South-West-North	41,000,000	410,000 sq. miles	Rich in minerals
Central-North-East-South	42,000,000	420,000 sq. miles	Rich in minerals
Central-North-West-South	43,000,000	430,000 sq. miles	Rich in minerals
Central-East-South-West	44,000,000	440,000 sq. miles	Rich in minerals
Central-East-North-West	45,000,000	450,000 sq. miles	Rich in minerals
Central-South-East-North	46,000,000	460,000 sq. miles	Rich in minerals
Central-South-West-North	47,000,000	470,000 sq. miles	Rich in minerals
Central-North-East-South	48,000,000	480,000 sq. miles	Rich in minerals
Central-North-West-South	49,000,000	490,000 sq. miles	Rich in minerals
Central-East-South-North	50,000,000	500,000 sq. miles	Rich in minerals
Central-East-North-South	51,000,000	510,000 sq. miles	Rich in minerals
Central-South-East-North	52,000,000	520,000 sq. miles	Rich in minerals
Central-South-West-North	53,000,000	530,000 sq. miles	Rich in minerals
Central-North-East-South	54,000,000	540,000 sq. miles	Rich in minerals
Central-North-West-South	55,000,000	550,000 sq. miles	Rich in minerals
Central-East-South-North	56,000,000	560,000 sq. miles	Rich in minerals
Central-East-North-South	57,000,000	570,000 sq. miles	Rich in minerals
Central-South-East-North	58,000,000	580,000 sq. miles	Rich in minerals
Central-South-West-North	59,000,000	590,000 sq. miles	Rich in minerals
Central-North-East-South	60,000,000	600,000 sq. miles	Rich in minerals
Central-North-West-South	61,000,000	610,000 sq. miles	Rich in minerals
Central-East-South-North	62,000,000	620,000 sq. miles	Rich in minerals
Central-East-North-South	63,000,000	630,000 sq. miles	Rich in minerals
Central-South-East-North	64,000,000	640,000 sq. miles	Rich in minerals
Central-South-West-North	65,000,000	650,000 sq. miles	Rich in minerals
Central-North-East-South	66,000,000	660,000 sq. miles	Rich in minerals
Central-North-West-South	67,000,000	670,000 sq. miles	Rich in minerals
Central-East-South-North	68,000,000	680,000 sq. miles	Rich in minerals
Central-East-North-South	69,000,000	690,000 sq. miles	Rich in minerals
Central-South-East-North	70,000,000	700,000 sq. miles	Rich in minerals
Central-South-West-North	71,000,000	710,000 sq. miles	Rich in minerals
Central-North-East-South	72,000,000	720,000 sq. miles	Rich in minerals
Central-North-West-South	73,000,000	730,000 sq. miles	Rich in minerals
Central-East-South-North	74,000,000	740,000 sq. miles	Rich in minerals
Central-East-North-South	75,000,000	750,000 sq. miles	Rich in minerals
Central-South-East-North	76,000,000	760,000 sq. miles	Rich in minerals
Central-South-West-North	77,000,000	770,000 sq. miles	Rich in minerals
Central-North-East-South	78,000,000	780,000 sq. miles	Rich in minerals
Central-North-West-South	79,000,000	790,000 sq. miles	Rich in minerals
Central-East-South-North	80,000,000	800,000 sq. miles	Rich in minerals
Central-East-North-South	81,000,000	810,000 sq. miles	Rich in minerals
Central-South-East-North	82,000,000	820,000 sq. miles	Rich in minerals
Central-South-West-North	83,000,000	830,000 sq. miles	Rich in minerals
Central-North-East-South	84,000,000	840,000 sq. miles	Rich in minerals
Central-North-West-South	85,000,000	850,000 sq. miles	Rich in minerals
Central-East-South-North	86,000,000	860,000 sq. miles	Rich in minerals
Central-East-North-South	87,000,000	870,000 sq. miles	Rich in minerals
Central-South-East-North	88,000,000	880,000 sq. miles	Rich in minerals
Central-South-West-North	89,000,000	890,000 sq. miles	Rich in minerals
Central-North-East-South	90,000,000	900,000 sq. miles	Rich in minerals
Central-North-West-South	91,000,000	910,000 sq. miles	Rich in minerals
Central-East-South-North	92,000,000	920,000 sq. miles	Rich in minerals
Central-East-North-South	93,000,000	930,000 sq. miles	Rich in minerals
Central-South-East-North	94,000,000	940,000 sq. miles	Rich in minerals
Central-South-West-North	95,000,000	950,000 sq. miles	Rich in minerals
Central-North-East-South	96,000,000	960,000 sq. miles	Rich in minerals
Central-North-West-South	97,000,000	970,000 sq. miles	Rich in minerals
Central-East-South-North	98,000,000	980,000 sq. miles	Rich in minerals
Central-East-North-South	99,000,000	990,000 sq. miles	Rich in minerals
Central-South-East-North	100,000,000	1,000,000 sq. miles	Rich in minerals

When all responses have been given to these questions, children locate the objects in answer to the following:

"How many big chairs are at the front of the room?"

"How many plants are in the window?"

"How many books are on this table?"

"Show me two eyes; two hands; two ears; two fingers."

"What did you do when you showed me two fingers?"

What do you start with when you have to count two? What number did we learn to write yesterday?"

"Find the card up here which has only one thing on it. Who can find a card with two things on it? Is there another card to show two things? Find it. How many cards have one thing on them? (One). How many cards have two things? (Two). See if you can take out your number boxes and find one button. Put it up at the left and near the top of your desk. Take out one more button and put it near it. How many are there now?"

"Put two pegs under the buttons."

"Put one block under the pegs. Put another block there. How many blocks are there now?"

"Cover two pegs. Hold up two blocks. Cover two buttons. Pick up one peg. How many pegs are left?"

"This is the number 2. (Hold up card). What number will it come after on the number chart? (Attach number two with a picture with two objects to the number chart).







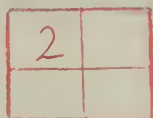


Lesson 4Aim:

To teach the correct formation of the number 2.

Materials:

Arithmetic paper folded in fourths with the number 2 made by the teacher as shown in diagram.

Procedure:

"Yesterday we put the number 2 on our number chart. Who can find it? Today we shall learn to write that number. This is where we start to make two." (Teacher demonstrates at the blackboard several times).

"See if you can sky-write the number 2." (Children form the number two in the air as teacher moves the chalk in the form of the number 2).

As each child receives his paper with the number 2 written on it he follows the directions to trace the teacher's 2 and go on to make more of the same number in the other boxes. "Trace this 2 like this. (Demonstrate). After you trace this 2 make another 2 in this box (indicate), another 2 in this box (indicate lower left) and another 2 in this box." (Indicate lower right).

Teacher checks each paper and notes those children needing additional help on the formation of 2. This help is





given in the period set aside for individual instruction at another part of the day.

### Lesson 5

#### Aim:

To teach the number names, one and two.

To begin a chart showing what may be bought for 2¢.

#### Materials:

Flashcards containing the words one and two.

Oak tag 12" x 18" on which has been mounted candy bought for 2¢.

#### Procedure:

"We have started a number chart. What numbers did we put on it? Which one did we put on first? Yes, we put 1 on first because that is the way we start to count. That is the number 1. (Indicate). Today we can see the word one. This is the word one. (Show card with word one). Say the word. Watch the way we write this word. (Teacher demonstrates at blackboard). Who can show me this number of desks? (Point to one on card). Find this number of erasers. Show us where this word is on the blackboard. When I put this word on the number chart I must put it beside the number 1, like this. (Put word on number chart). Now we have a picture for one, the number for it and the word for it."

"What is the next number we have on the chart? This is the word two. (Hold up card with word two). Say the word."





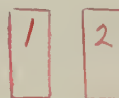


Lesson 6Aim:

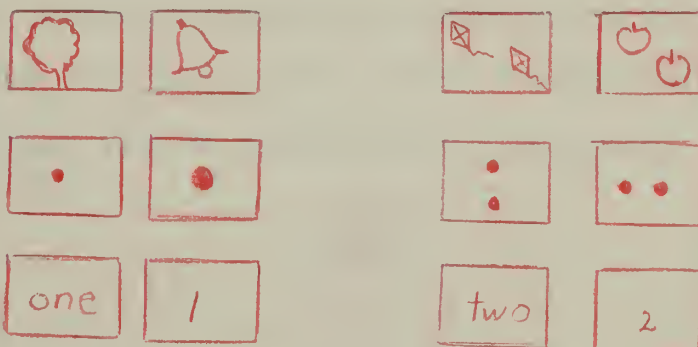
Review of numbers 1 and 2, the number names of each, the symbols, and number of objects corresponding to each.

Materials:

Cards 1" x 4" with symbols 1, 2.



Cards 2" x 3" with pictures (semi-concrete) or dots (abstract).

Procedure:

"What numbers are on the cards? Put 1 on the left of your desk. (Demonstrate). Put card 2 on the right. (Demonstrate). Find a picture with one thing in it. Put it under the number 1. If you see two pictures on a card, where will you put it? (under the card 2). Where will you put the card with one dot? Where will the card with two dots go? See if you can find the right places for your other cards with pictures and dots."



The first of these is the fact that the  
 system is not a simple one. It is a  
 complex one, and it is not possible to  
 describe it in a simple way. It is a  
 system of many parts, and it is not  
 possible to describe it in a simple way.  
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## Lesson 7

### Aim:

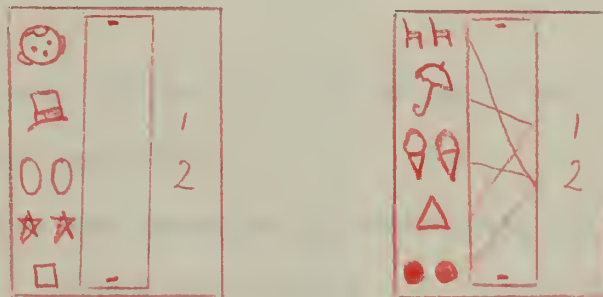
Identification of symbols 1 and 2 with the correct number of objects.

### Materials:

Oak tag 9" x 12" with pictures (semi-concrete) and dots, stars, lines (abstract) drawn at left.

Numbers 1 and 2 at right.

Paper stapled between pictures and numbers on which children draw lines connecting pictures of objects with corresponding numbers. (Paper may be removed after each use).



(Each oak tag unit is different. As each is used the paper in center section may be removed and the unit used again if individual help is needed).

### Procedure:

"Put your finger on the first little picture. How many things do you see? Draw a line on the paper from the picture. (Demonstrate). Draw a line from the next picture to the right number. See if you can find the right number for each picture as you go down the card."



## Lesson 8

### Aim:

To proceed from what is known about the number three to systematic instruction in the meaning of number three through use of semi-concrete and concrete material.

### Materials:

Oak tag cards on which are pasted colored objects.



Number boxes

### Procedure:

Teacher asks, "What do you think of when I say three? What does three mean to you?"

(These are the recorded answers given by children).

three chairs	three dog houses	three cents
three ice creams	three bunnies	three lollipops
three-year-old baby	three doggies	three triangles
three beds	three leaves	three balls
three cars	three tomatoes	the <del>Three</del> Bears
three houses	three puppies	three lions
three hammers	three pencils	three cars
three scissors	three lamps	three elephants
three goldfish	three squares	

When all responses have been given, attention is directed to the cards on which are mounted colored paper

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101

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102

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103

104

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objects.

"Which card has two things on it? Find the card with one thing. Which card has three things on it? Which card has more than three things on it?"

"Show us three windows. Put three pieces of chalk on the table. Point to three flowers."

"Take out your number boxes and find three blocks. Put one block at the top and on the left of your desk like this. (Demonstrate). Put another block next to it like this. (Demonstrate). How many blocks are there now? Put another one there. Now how many are there?"

"Find one peg. Put it under the blocks like this. (Demonstrate). Put another next to it. How many more do you need to make three? Put another one there to make three pegs."

"Put two buttons on your desk. Put another one next to them. How many are there?"

"Take away 1 block. How many are left? Put the two back in your box."

"Put away one peg. How many pegs are left? Put the two away."

"Put away two buttons. How many are left? Put away the one that is left. Put the boxes away."

"Here is the number 3. (Hold up card with 3). Where will it go on our number chart? What numbers are before 3 on the chart? Show us the picture with two things. Show us the number 2. Where is the word two? Where is the word one?"







Lesson 9Aim:

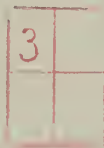
To teach the correct formation of the number 3.

To teach the number name three.

Materials:

Arithmetic paper folded in fourths with a specimen 3 in the top left box.

Flashcard with the word three.

Procedure:

"The next number we put on our number chart yesterday was three. This is what it looks like on the chart. This is the way we write the number 3. (Demonstrate). This is the word three. (Show the card). Say three. Show me this number of fingers. Let us put the word three on the number chart. Show me the word three on the blackboard. (This has been on before the lesson). Show me where the number 3 is written. This is the way we sky-write the number. (Demonstrate). See if you can sky-write 3 as I write it on the blackboard."

As the paper is passed the teacher reminds children to trace the 3 put on each paper by the teacher. As the children fill in the remaining boxes with their own numbers, as in the lessons on 1 and 2, the teacher watches each child



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form the number 3 as she stands by his desk. Those needing extra help are given it at the time and, also, at another period when individual help is given.



Lesson 10Aim:

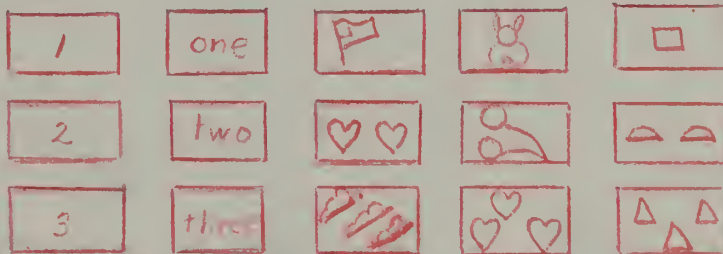
Review of numbers one, two, and three, the written names, the number symbols, the order--1,2,3, and the number of objects corresponding to these numbers.

Materials:

Cards 1" x 4" with symbols 1, 2, and 3.



Cards 2" x 3" with pictures (semi-concrete) and dots (abstract).

Procedure:

"Find number 1. Hold up the number 1. Hold up the word one. Hold up number 3. Hold up the word three. Put the number 1 at the top and at the left of the desk. (Demonstrate) Beside it put the word one. Find all the pictures with one thing and put them in a long row beside the word and number 1. Put the number 2 at the left of your desk. (Demonstrate). Put the word, two beside it. Find all the pictures with two things and put them in a long row beside the number and the word two. Find the number and the word three. Put them at the left of the desk. Put all the pictures of three things in a long row beside the number and the word three."





Something for 1¢



1¢



1¢



1¢



1¢



1¢



1¢



1¢

Something for 2¢



2¢



2¢



2¢



2¢



2¢

Something for 3¢



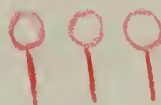
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Lesson 11Aim:

Review recognition of and collection idea of numbers 1, 2, and 3.

Materials:

Toothpicks

Oak tag 9" x 12" marked into six parts each with a number 1, 2, or 3 under a slit.

<u>3</u>	<u>2</u>	<u>1</u>
<u>2</u>	<u>1</u>	<u>3</u>

Procedure:

Teacher demonstrates with sample card before class, inserting toothpicks into slit above the first number.

"What is this number? How many toothpicks will I use to show this number? How many shall I need to show the next number?"

"After demonstration children work on individual cards. Each card has the numbers placed differently in case there is need for individual help in which case a new situation is presented on a new card.

<u>1</u>	<u>3</u>	<u>2</u>
<u>2</u>	<u>1</u>	<u>3</u>

<u>2</u>	<u>1</u>	<u>3</u>
<u>1</u>	<u>2</u>	<u>3</u>

1. The first part of the paper is devoted to a general discussion of the problem.

2. The second part is devoted to a detailed analysis of the case of a single particle.

3. The third part is devoted to a detailed analysis of the case of a system of particles.

4. The fourth part is devoted to a detailed analysis of the case of a system of particles.

5. The fifth part is devoted to a detailed analysis of the case of a system of particles.

6. The sixth part is devoted to a detailed analysis of the case of a system of particles.

7. The seventh part is devoted to a detailed analysis of the case of a system of particles.

8. The eighth part is devoted to a detailed analysis of the case of a system of particles.

9. The ninth part is devoted to a detailed analysis of the case of a system of particles.

10. The tenth part is devoted to a detailed analysis of the case of a system of particles.

11. The eleventh part is devoted to a detailed analysis of the case of a system of particles.

12. The twelfth part is devoted to a detailed analysis of the case of a system of particles.

13. The thirteenth part is devoted to a detailed analysis of the case of a system of particles.

14. The fourteenth part is devoted to a detailed analysis of the case of a system of particles.

15. The fifteenth part is devoted to a detailed analysis of the case of a system of particles.

16. The sixteenth part is devoted to a detailed analysis of the case of a system of particles.

17. The seventeenth part is devoted to a detailed analysis of the case of a system of particles.

18. The eighteenth part is devoted to a detailed analysis of the case of a system of particles.

## Lesson 12

### Aim:

Review of terms big, large, little, small, largest, middle, shorter.

### Materials:

Gray construction paper 6" x 9"

Chalk for each child.

Brown crayons.

As teacher breaks large piece of chalk each child watches and takes the largest portion of the piece broken for him. The chalk is not used as the whole piece since it would be too cumbersome for the child to handle on the piece of work to be done. This procedure of breaking the chalk is time consuming but it is a good check on each child's knowledge of the term largest. If necessary, it may be explained that largest may be used like biggest and largest is more adult.

### Procedure:

Teacher demonstrates making of pussy-willows on gray paper with wide line from top to bottom of paper. It is preferable that this line be not too straight.



To this line are added white spots to give the appearance of pussy-willows. At the base of each white spot and close to the brown stem are added brown 'cups' to hold the white spots to the brown stem. Three of these are made and when cut out two are made shorter. The largest is placed in the middle



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of another piece of colored paper and the others placed on either side. A vase is made free hand and pasted over the three pussy-willows.





Lesson 13Aim:

To proceed from what is known about the number four to systematic instruction in the meaning of number four through use of concrete and semi-concrete material.

Materials:

Number boxes containing concrete materials.

Oak tag cards 9" x 12" on which colored paper objects are pasted as in diagram.

Procedure:

The following responses were recorded as individual children gave answers to the following questions:

"What is four? What does four mean to you? What do you think of when I say four?"

four cars	four balls	four straws
four fingers	four apartments	four books
four tables	four ponies	four schools
four chairs	four trees	four dolls
four trucks	four stars	four boxes
four steamshovels	four eggs	

somebody four years old

a car pulling a trailer, a truck, and a steam shovel





four windows on a car

four points on a steam shovel

four little tiny windows on one window

four legs on one animal

Oak tag cards are shown for all to see and the following directions are given:

"Find the card with one thing on it. Where is the card with three things on it? Who can find the card with the most on it? Count them. How many are there?" (Four).

"Can you hold up four fingers on one hand? Who can find four pictures in this room? Pick out four girls; four boys. Pick out four beans from your number boxes. Put three beans on one side of the desk. (Demonstrate). How many beans are left? Put two buttons at the top of the desk. Put two more buttons near them. How many are there now? Put one block near the bottom of the desk. Put out two more blocks. How many more will you need to make four blocks? Put back three buttons. How many buttons are left? Put back two blocks. How many blocks are left? Put back one bean. How many are left?

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Lesson 14Aim:

To teach the correct formation of the number 4.

To teach the word four.

Procedure:

"What are the numbers we have put onto our number chart? Can you tell what the next number is going to be? Yes, it is the number 4. Where shall we put it on the chart? Here is the word four. (Expose flashcard with four). Say the word. Who can find this number of pictures in the room? Hold up this number of fingers." (Indicate the number four on the card as these commands are given).

"This is the way the word four is written. (Demonstrate). This is the way we write the number 4. We must always remember to go to the right. How do we remember our right hand? Yes, it is the hand we salute our flag with. Point to the right. Hold up your right hand. Watch again while I write the number 4. (Demonstrate). See if you can sky-write the 4 as I write it on the blackboard."

When the papers have been passed children follow the directions to trace the 4 made by the teacher. After tracing the 4 in the top left box children follow directions to fill in the remaining boxes with more of the number 4. As this is done the teacher checks each child as he writes the number to make certain he is using the correct strokes.









## Lesson 15

### Aim:

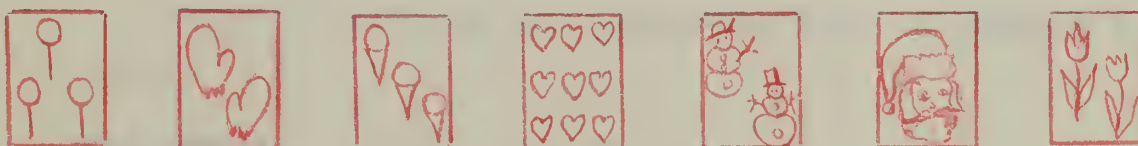
Review of terms most, more, as many as, and reading of words one, two, three.

Review of cards with colored objects 1, 2, and 3 in numbers.

### Materials:

Flashcards with the words one, two, and three.

Oak tag cards 9" x 12" with objects made with colored paper such as cookies, snowmen, ice cream cones, stars, lollipops, flowers, and so on.



### Procedure:

Cards are placed within sight of children.

"Find the card which has the most things on it. How many are on it?"

Teacher indicates cards with one and three objects respectively. "Which card has more on it?"

Teacher indicates a card with two objects and another with three objects. "Which of these has more on it? How many are there on this? (Three). How many on this? (Two). How many more are there on this (three) than on this (two)?"

Teacher indicates card with two objects. "Find another card with as many as there are on this card. Find



another card with as many as there are on this card (card with three objects)."

"Show us the card with this number of things on it. (Hold up card with the word one.) Find the card with this many. (Hold up card with three on it.) Who can find the card with this many? (Hold up the card with two on it). Who can find two cards with this many on them?" (Hold up the word three.)

### Lesson 16:

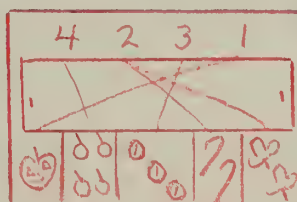
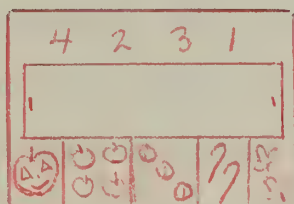
#### Aim:

Review of symbols and collection idea of numbers 1, 2, 3, and 4.

#### Materials:

Oak tag cards 9" x 12"

Each card with pictures and numbers placed similarly to the following but with no two cards alike:



#### Procedure:

"Put your finger on number 1, number 2, 3, 4. Draw a line from the picture with one thing to the number 1. See if you can find the right number to go with every picture."



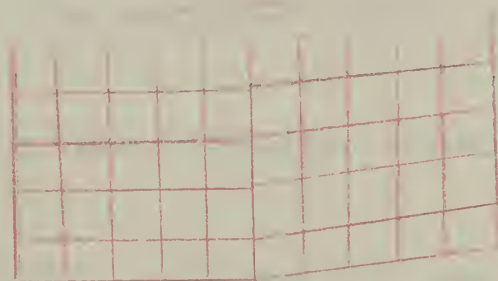


Lesson 17Aim:

To proceed from what is known about the number 5 to work with concrete materials in the beginning of systematic instruction in the meaning of number five.

Materials:

Blocks before the teacher arranged five in a row and 5 deep.



Pegs and number board before the teacher.

Colored pipe cleaners.

Materials in number boxes.

Procedure:

Teacher asks, "What does five mean to you. What do you think about when I say five?"

(The following were recorded as individual responses were made).

five things

five points on a star

five children

five beads on a necklace

five bluejays

five blocks

five chairs

five tables

five little windows on  
on one big window

five desks

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To work with the large blocks before the teacher the following is said, "How many rows of blocks do you see here? How many blocks are there down this side? (Indicate). How many rows are there on this side? How many are there on the bottom?"

"How many pegs do you see in this large peg board? Count them."

"How many pipe cleaners are here? How many blue pipe cleaners? (Four). How many red? (One). How many are there all together?"

"Take out five blocks from your number box. Put them in front of you."

As the blocks are placed the different positions are noted. "See how this boy has put his. He has three on the bottom and one on top. Can you tell us how you have your five pegs?" Individuals can tell about three blocks in the top row (when the two rows are put out but not one row balancing the others) and two blocks next to me.



"I have two here and there I have three. All together I have five."

Teacher asks, "Show me five things you have as part of your body." (Fingers).

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental procedures and the statistical analysis performed.

3. The third part of the document presents the results of the study. It includes a series of tables and graphs that illustrate the findings of the research. The data shows a clear trend of increasing activity over time.

4. The fourth part of the document discusses the implications of the findings. It suggests that the results have significant implications for the field of study and may lead to further research in this area.

5. The fifth part of the document concludes the study. It summarizes the main findings and provides a final statement on the importance of the research.

Lesson 18Aim:

To teach the correct formation of 5.

Materials:

Arithmetic paper folded in fourths with 5 in top left box.

Procedure:

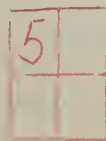
To insure correct formation and placement of final stroke correctly, teacher demonstrates at board how the number five is like the gentleman who never puts on his hat until leaving the school. As she writes the fives, these words are said;

"Down

"A big mouth

"Put his hat on"

Children sky-write the number in the air and then trace teacher's copy on their own papers. Other fives are made in the remaining spaces of the arithmetic paper folded in fourths. (As the paper is folded note is made of the fourths and children count the oblongs and see the four parts which constitute the fourths into which the paper is folded). Each paper is checked as it is finished and help given where needed.





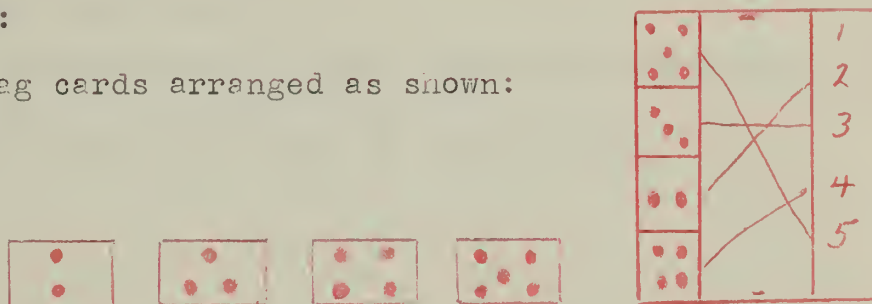


Lesson 19Aim:

To review symbols 1, 2, 3, 4, 5

Materials:

Oak tag cards arranged as shown:



Buttons

Oak tag cards with dots arranged in domino patterns.

Procedure:

Children draw lines from the picture with one object to the number 1, from the picture with two objects to number 2 and so on.

As the cards with dots arranged in the domino patterns are held up children use buttons to place a similar pattern on the table. After each child has arranged the buttons before him one is chosen to "tell the story."

For card two the teacher points out, "There is one dot here at the top and one here at the bottom. You have buttons on the table before you. See if you can make two buttons go the way these dots go. (Demonstrate). Now you can say, 'I have one button at the top and one button at the bottom. All together there are two buttons!'"

"See if you can fix your buttons like this card. (Card with three dots). Now tell the story."



For card 4 it is noted by the teacher that the dots are arranged as a square. The story may be told, "I have two buttons at the top and two buttons at the bottom. All together there are four."

It is also pointed out that the buttons for five may be arranged as the square with one in the center.

## Lesson 20

### Aim:

To review formation of numbers 1, 2, 3, 4, 5

### Materials:

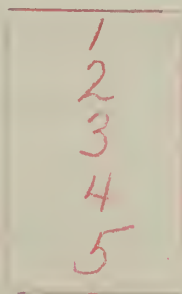
Arithmetic paper

Pencils

### Procedure:

Teacher demonstrates the formation of the numbers 1, 2, 3, 4, and 5 as class do sky-writing with teacher.

Individuals work at board and teacher checks work of each before he returns to his desk to write the numbers in serial order on his paper.



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JANUARY 1964

TO THE HONORABLE CHAIRMAN  
OF THE BOARD OF TRUSTEES  
OF THE UNIVERSITY OF CHICAGO

AND TO THE HONORABLE CHAIRMAN  
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## Lesson 21

### Aim:

To write the number which tells the number of sounds heard.

To review the formation of number 5.

### Materials:

Arithmetic paper folded in fourths and the fourths not ed.

Bell to tap.

### Procedure:

Teacher demonstrates formation of five calling attention to the last stroke as the gentleman's hat put on last. Three figure 5's are put in three oblongs on the arithmetic paper and in the last oblong is put the domino picture of five.

"What can you make first? (A square with four dots). When the square with four dots is made, how many more dots do you need to make five?" (Demonstrate).

On the other side of the paper are put the numbers 3, 1, 2, and 5 as the teacher taps the bell the corresponding number of times. This is preceded by this instruction:

"I am going to tap this bell. You will not see it as I place it behind me but you can hear it. One of you will come to write a number on the board. It will be the number which tells how many times you heard the bell tapped."

After this has been demonstrated at the blackboard the work follows on the paper. As the teacher taps the bell

The first part of the document discusses the importance of maintaining accurate records of all transactions.

### 1. Introduction to the Accounting System

This section outlines the basic principles and objectives of the accounting system.

The system is designed to provide a clear and concise overview of the company's financial performance.

The accounting system is based on the following principles:

- Accuracy: All transactions must be recorded accurately and in a timely manner.
- Consistency: The system must be applied consistently across all departments.
- Transparency: All transactions must be clearly documented and auditable.

The system is designed to be flexible and adaptable to changing business needs.

The system is designed to be user-friendly and easy to learn.

The system is designed to be secure and reliable.

The system is designed to be scalable and able to handle large volumes of data.

The system is designed to be cost-effective and efficient.

The system is designed to be easy to integrate with other business systems.



three times, once, twice, and five times, the children write as in the following diagram:

3	1
2	5

Papers are checked and individual work given where necessary on number formation.

## Lesson 22

### Aim:

To establish value of nickel.

To show meaning of ¢ for cent.

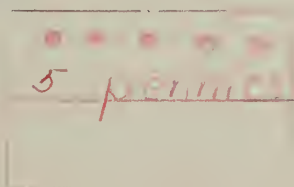
### Materials:

Nickels and pennies to handle and trace.

Arithmetic paper and pencil.

### Procedure:

On paper folded into halves (term noted) children trace five pennies and letter the word and number.



On lower half is traced the nickel. "How many pennies do you need to have as much as a nickel? When you see this sign in the store what does it mean? Yes, it means something costs five cents or five pennies or a nickel.

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

2. The second part of the paper is devoted to a detailed study of the case of the system of equations

3. The third part of the paper is devoted to a study of the case of the system of equations

4. The fourth part of the paper is devoted to a study of the case of the system of equations

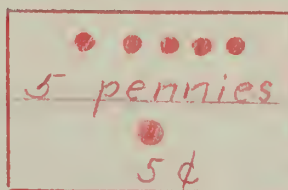
5. The fifth part of the paper is devoted to a study of the case of the system of equations

6. The sixth part of the paper is devoted to a study of the case of the system of equations

7. The seventh part of the paper is devoted to a study of the case of the system of equations

This is the way the man in the store makes his sign to tell you it costs five cents."

Teacher demonstrates cent sign. Children trace nickel and write 5¢ under it.



### Lesson 23

#### Aim:

Review formation of numbers 1, 2, 3, 4

Use of these numbers in serial order.

Use of terms first, second, third, fourth.

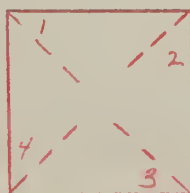
#### Materials:

Colored paper 4" x 4" for use in making pinwheels.

Common pin and snort stick.

#### Procedure:

Teacher demonstrates folding on the diagonal and numbering points as shown:



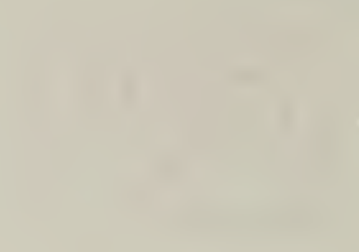
The first point numbered one is fastened to point 2 or the second point, then to the third point numbered 3, and, finally, to the fourth point numbered 4. Pin is then fastened

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into wood of the short stick.

After teacher has demonstrated she works step by step as class follows her directions to fold, number, cut, and pin.

## Lesson 24

### Aim:

Review of formation of numbers 1, 2, 3, 4, 5 and number of objects corresponding to these numbers.











### Materials:

Drawing paper, pencils, and crayons.

### Procedure:

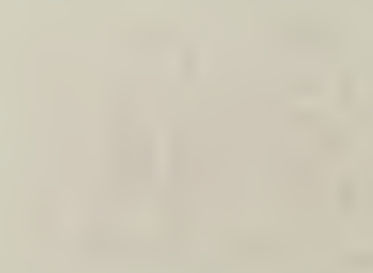
On paper previously folded into five oblongs are placed the numbers in order 1, 2, 3, 4, 5. Under each is placed the right number of objects. As teacher demonstrates at the blackboard and before children work on papers, it is pointed out that each new row will have one more object than the one before.

When objects are drawn a line is drawn and dots made according to the numbers at top of row.

1	2	3	4	5
				
				

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Lesson 25Aim:

Review of terms long, short, longest, top, bottom.

To present the symbol " to indicate inches.

Materials:

Rulers

Pencils and paper

Procedure:

Discussion of ruler and its use.

"Who uses a ruler? Why do we need rulers? What else do people use to measure with? (Show ruler and yardstick). When is it better to use a yardstick?" (This question was immediately answered correctly by a child with, "It doesn't take such a long time to measure big things with a yardstick.")

On papers children follow directions to draw a long line at the top of the paper and to draw a short line at the bottom of the paper.

The teacher demonstrates the necessity of starting at edge of ruler and stopping at correct point to show exactly a line three inches long. Children draw a line three inches long. Teacher demonstrates how plans are marked with " to indicate inches. Children mark the line 3" and then follow directions to make a line five inches long and mark it and another one inch long and mark it.

The last direction is to put a cross on the longest lone on the paper. Each paper is checked at the end of the

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lesson and individual help given where required.

## Lesson 26

### Aim:

To review use of ruler and numbers 2, 3, and 4.

To review terms tall, short, shortest, inches.

### Materials:

Number boxes

Rulers and paper and pencils

### Procedure:

"How would you hold your paper so you could draw something tall? Hold up the longest thing in your number box. Hold up the shortest thing. Will the longest thing fit on your paper if you were going to draw it?"

"Make a picture of a telephone pole on your paper. Will it be tall or short? Draw a picket for a short fence."

On the other side of the paper are followed directions to draw a line down the paper four inches long, draw a line three inches long, and draw a line two inches long. Each line is properly marked as in previous less with " as 4", 3", and 2".

The final direction is to mark with a cross the shortest line.



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## Lesson 27

### Aim:

To review cards with dots arranged in domino patterns for 1, 2, 3, 4, and 5.



### Materials:

Pumpkin seeds



Oak tag cards with dots arranged

### Procedure:

As the teacher holds up the cards with domino patterns children arrange pumpkin seeds to look like card. Individuals tell the "story" for each card. "I have two seeds at the bottom and one seed at the top. All together I have three seeds."

"I have two seeds at the top and two seeds at the bottom. That makes four seeds."

"I have four seeds like a square and one seed in the middle. All together I have five seeds."

When the seeds are put into number boxes the domino cards are shown again to promote ease in recognizing groups as teacher points out that it is not always necessary to count one, two, three each time since after awhile we can tell it is the card with three dots or a picture with three things or a pocket with three pennies and so forth.





## Lesson 28

### Aim:

Review of the following terms which have been presented incidentally as various rows are called and the teacher has pointed to the first row, the second row, the third row:

<u>row</u>	<u>first</u>	<u>second</u>	<u>third</u>	<u>fourth</u>	<u>fifth</u>
------------	--------------	---------------	--------------	---------------	--------------

To show the increase of one as the number series grows.

### Materials:

Squares of colored paper to fit on desks

### Procedure:

"We are going to make rows with squares on the desks. In the first row at the top we shall have one square. Under the first row we shall have the second row with two squares. In the third row we shall have three squares. How many squares do you think the next row will have? (4). What row will we call this next row? (Fourth). What will be the name of the next row? (Fifth). How many squares will go in it? (5).

"Look at the first and the second rows. How many more squares are there in the second row than in the first row? How many more are there in the third row than in the second row? How many more in the fourth row than in the third? How many more in the fifth than in the fourth?"

1870

1871

1872

1873

1874

1875

1876

1877

1878

1879

1880

1881

1882

1883

1884

1885

1886

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1890

1891

1892

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1895

1896

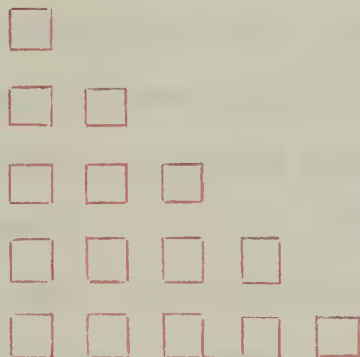
1897

1898

1899

1900

Distinguish between the first row horizontally and vertically. "How many are there in the first row that goes this way? (Point to row vertically). How many are there in the fifth row going this way? (Indicate).



### Lesson 29

#### Aim:

To review numbers 1, 2, 3, 4, 5 in series

To write the correct number to correspond with the number of sounds heard.

#### Materials:

Bell to tap

Paper and pencil

#### Procedure:

Teacher reviews formation of numbers at board and demonstrates arrangement of numbers at top of paper divided into five oblongs.

"If we start with 1 at the top of this box and 2 at the top of the next box, what numbers will be written in the next three boxes? (3, 4, 5). If I tap the bell two times a 2 will be written in the "two" row. If the bell is tapped four times the number 4 will be written in the "four" box."



The bell is tapped once, three times, and five times. The numbers 1, 3, and 5 are written in their correct places. "What numbers are missing in this row? (2 and 4). Why are they missing? Yes, I did not ring the bell twice, that means two times, nor did I ring the bell four times."

A line is drawn under the set of numbers just written and the bell is tapped again, this number of times and in this order--1, 2, 4, 5. "Who can tell what was left out that time? Yes, the number 3 was left out because the bell was not rung three times."

1	2	3	4	5
1		3		5
1	2		4	5

Papers are checked for correct formation of the numbers and help is given where needed.

1. The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations. The second part of the paper discusses the methodology used in the study. It mentions the data sources and the statistical methods used. The third part of the paper discusses the results of the study. It mentions the findings and the conclusions. The fourth part of the paper discusses the implications of the study. It mentions the policy implications and the future research. The fifth part of the paper discusses the conclusion. It mentions the main findings and the recommendations.

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Lesson 30Aim:

Numbers 1, 2, 3, 4, 5 in series and 5,4,3,2,1

Materials:

Set of steps

Procedure:

Each child jumps up five steps counting one, two, three, four, five. As the child jumps down he says five, four, three, two, one.

Lesson 31Aim:

To begin background work for subtraction

Materials:

Domino cards

Beans

Procedure:

As domino cards



are held up children arrange beans before them in the pattern as that of the card. When the pattern has been set up one bean is taken away and the story told by the teacher. "I had three beans. I took away one. Now I have only two."

"How many beans do we need for this card?"



Take away 1 bean. Tell the story. How many beans do we need for this card?



Take away 1. Tell the story."

Following directions printed on blackboard, the children work by themselves after teacher demonstrates the first direction.

1890

1891

1892

1893

1894




1895

1896

1897

Follow up work done at desks:

Draw 3	
Take away 1	
Draw 5	
Take away 1	
Draw 4	
Take away 1	

	2
	4
	3

### Lesson 32

#### Aim:

To proceed from what is known about the number six to systematic instruction in the meaning of number 6 through the use of concrete and semi-concrete materials.

#### Materials:

Number boxes

Empty egg box with six sections

Oak tag cards

#### Procedure:

"When I say the number 6, what do you think of?  
What does 6 mean to you?"



## Responses received:

6 o'clock	6 grades in school	6 oceans
6 witches	6 absent	6 roses
6 years old	6 floors	6 hundred
6 cups	6 dishes	6 radios
6 toys	6 buttons	6 tigers in a row
6 rabbits	6 blackboards	the number after 5
6 Easter eggs	6 stars	6 boys in a row
6 horses	6 little windows in a big one	the number before 7, 8, 9, 10, 11, 12

After responses have been made to the foregoing questions the oak tag cards are put within sight of all the children and the following questions are asked:

"How many cards are here? Who can find the card with five things on it? Where is the card with only three things on it? Which card has six things on it? Which card has the most on it?"

"How many parts do you see in this egg box? How many eggs would fit into it? What is another way of saying six eggs?" (Half dozen).

When the number boxes have been put on the desks the children are instructed to put six things in a row. Individuals stand to tell what was used to make up the six objects as, "I have five blue blocks and one red block. All together I have six blocks in this row." "I have one red peg and two yellow pegs and three green pegs and all together I have six pegs."





As these stories are told the teacher illustrates each on the blackboard as:



Other children count to see if each row totals six. The number 6 is added to the number chart.

### Lesson 33

#### Aim:

To teach the correct form of 6

#### Materials:

Paper folded into fourths with a 6 written by the teacher on each paper in the top left box.

#### Procedure:

Teacher demonstrates at the board.

Children sky-write the 6 in the air as the teacher forms it at the board.

Children trace the teacher's copy and then go on to write 6 in each of the remaining boxes. The teacher checks each child as he forms the number in her presence. Those needing additional help are given it at the time or at another period for individual instruction.

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Lesson 34Aim:

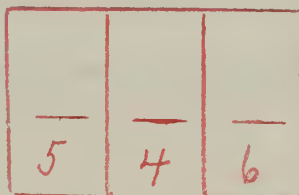
Review of symbols 4, 5, 6

Selecting the correct number of objects for 4, 5, 6

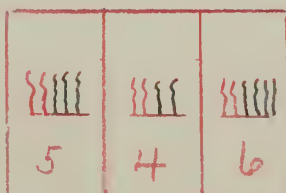
Materials:

Colored pipe cleaners--blue and pink

Oak tag 9" x 12" with slits under which are marked  
4, 5, 6, as in illustration

Procedure:

Children fit the correct number of pipe cleaners into the slits according to the number listed under each slit, using two colors in each slit. The story is told for each number as, "I have 2 pink and 4 blue. All together I have 6."





Lesson 35Aim:

To review the component parts of 6

Materials:

Oak tag 9" x 12" with numbers as in diagram

Colored paper squares, circles, and triangles

Procedure:

Children put number of squares or circles as indicated under slits in each row of the card and then write the total number on the paper at end of row.

<u>4</u> ▲	<u>2</u> ▲	- 6
<u>5</u> ●	<u>1</u> ●	6
<u>3</u> ■	<u>3</u> ■	6 -

<u>3</u> ●	<u>3</u> ●	6
<u>1</u> ▲	<u>5</u> ▲	6
<u>2</u> ■	<u>4</u> ■	6 -

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. This is essential for ensuring the integrity of the financial system and for providing a clear audit trail. The second part of the document outlines the procedures for handling disputes and resolving conflicts between parties. This includes a detailed description of the arbitration process and the role of the arbitrator.

2. The third part of the document describes the various methods used to collect and analyze data. This includes a discussion of the different types of data sources and the techniques used to process and interpret the information. The fourth part of the document provides a summary of the findings and conclusions of the study.

3. The fifth part of the document discusses the implications of the findings for future research and practice. This includes a discussion of the limitations of the study and the need for further investigation. The sixth part of the document provides a list of references and a bibliography of the sources used in the study.

4. The seventh part of the document provides a detailed description of the experimental design and the procedures used to conduct the study. This includes a discussion of the different groups of participants and the tasks that they performed. The eighth part of the document provides a summary of the results of the study and a discussion of the implications for future research.

5. The ninth part of the document provides a detailed description of the data analysis procedures and the results of the statistical tests. This includes a discussion of the different types of statistical tests and the results of the chi-square test, the t-test, and the ANOVA. The tenth part of the document provides a summary of the findings and conclusions of the study.



Lesson 36Aim:

An understanding of subtraction through the use of concrete materials and reproduction of subtraction facts through drawings.

Materials:

Dot cards

Acorns

Arithmetic paper

Procedure:

As each dot card is held up the number of dots is told and the children make the pattern with the acorns. From each pattern as it is made are taken two nuts and the remainder told as, "I had four nuts and I took away two. Now I have only two." "I had five and I took away 2. Now I have 3."

To follow this work directions are carried out as indicated on the blackboard. The teacher demonstrates the first direction and then the children work alone.

Draw 3.	
Take away 2. ⊗ ⊖ ⊙	1
Draw 6	
Take away 2.	

Draw 5.	
Take away 2.	
Draw 6.	
Take away 2.	

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ARTS AND SCIENCES

1954

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Lesson 37Aim:

To review the component parts of 4, 5, and 6

To build a background for addition

Materials:

Blocks

Paper and pencil

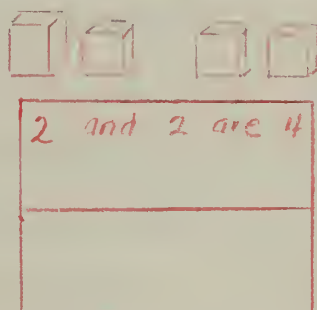
Procedure:

"Fold your paper like this in half. (Demonstrate).

How is it folded?" (In half).

"Put two blocks before you. Write 2 on your paper.

Put two more blocks. How many blocks are there now? Tell the story. (2 blocks and 2 blocks are 4 blocks). Write it on your paper like this in the top half:"



"Now put three blocks at the top edge of your paper like this. (Demonstrate). Write 3 on your paper in the bottom half like this. (Demonstrate). Now put two more blocks near the three blocks. How many are there all together? Write the 'story' like this. (Demonstrate 3 and 2 are 5.) On the top half of the other side of the paper we shall put a new story. Put four blocks at the top edge of your paper.



Write the number 4. Put another block near it. How many are there? Write the story."

Use a similar procedure for 3 and 3 are 6.

### Lesson 38

#### Aim:

An understanding of addition through use of concrete materials.

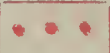

To introduce the sign  $\neq$  and  $\neq$

To use the sign  $\neq$  in addition with 5 and 6 as sums

#### Materials:

Pencil and paper

#### Procedure:

After reading "Patty and Her Pennies" in Our New Friends<sup>1/</sup> teacher draws illustration on board. "This is where Patty kept her pennies  one, two, three in a big pocket and  one, two in a little pocket. How many did she have all together? Put the pockets like this on your paper and write the story." (Demonstrate).



$$3 \neq 2 = 5$$







Instead of writing and every time we can use this little sign which means and  $\neq$ . Who can find the little sign which means are?" ( $=$ ).

<sup>1/</sup>Gray, William S., and Arbuthnot, May Hill. Our New Friends. Scott, Foresman and Co., Chicago, 1940, p. 42-46





Repeat for 4 pennies and 2 pennies in pocket as well as 1 penny and 5 pennies.

		
3	+	2 = 5
		
4	+	2 = 6
		
1	+	5 = 6

### Lesson 39

#### Aim:

Review of subtraction from 6

#### Materials:

Pennies



Pencil and paper



#### Procedure:

Directions are given to trace six pennies and to draw a pocket around them. (Demonstrate).



When this is done, the children are asked, "How could we show that this person with six pennies lost one?" (Cross out or color over one penny). In the empty box put the number which tells how many pennies are left if one is lost out of the pocket which had 6.

	5
	3

	4
	2

On the lower half of your paper put six pennies in a pocket. Three pennies are lost from this pocket. Cross out the three lost pennies. In the empty box write the number



which tells how many pennies were left. On the other side of your paper put six pennies in a pocket and show that two are lost. Write the number which tells how many pennies are left.

Use similar procedure for 6 minus 2.

#### Lesson 40

##### Aim:

An understanding of subtraction through the use of concrete materials.

To review the term oblong which is presented in the drawing period.

##### Materials:

Beans

Pencil and paper

##### Procedure:

"Fold your paper in halves. How many oblongs are there?"

"At the top and at the edge of your paper put 6 beans. (Demonstrate). Take away one of them. How many are left? This is the way we can write that story. (Teacher writes, '6 take away 5 leaves 1'). Write it in the top half of your paper like this." (Demonstrate).

"Put 6 beans again at the top edge of your paper. Take away four beans. How many are left? How can we write the story? Yes, we write '6 take away 2 leaves 4'." (Demonstrate).

the first of these is the fact that the  
the second is the fact that the

THE SECOND OF THESE FACTS

is the fact that the

the third is the fact that the

the fourth is the fact that the

the fifth is the fact that the

the sixth is the fact that the

the seventh is the fact that the

"Put six beans at the top edge of your paper again. Take away three beans. How many are left? How can we write the story? Yes, we write '6 take away 3 leaves 3'" (Demonstrate).

"Put the six beans at the top again. Take away four. How many are left? Write it as we did the others in the last half of your paper." (Demonstrate '6 take away 4 leaves 2').

"When you take the paper to your desk see if you can draw a picture to tell the story about the numbers you have in each half of the paper. The first half will look like this." (Teacher demonstrates).

6 take away 5 leaves 1
<del>X</del> <del>X</del> <del>X</del> <del>X</del> <del>X</del> O
6 take away 2 leaves 4
<del>X</del> <del>X</del> O O O O

6 take away 3 leaves 3
<del>X</del> <del>X</del> <del>X</del> O O O
6 take away 4 leaves 2
<del>X</del> <del>X</del> <del>X</del> <del>X</del> O O





Lesson 41Aim:

An understanding of addition through use of concrete materials and reproduction of addition facts through drawings.

Materials:

Pumpkin seeds

Pencil and paper

Procedure:

"Fold the paper in halves. At the top edge put one seed. Write number 1 on the paper. Put five more seeds near the one. What is the story? Yes, five and one are six. This is the way we can write it-- $5 + 1 = 6$  What part means and? What means are?"

"Put three seeds at the edge of your paper. Write the number 3. Put three more seeds near the others. How many are there all together? How will we write the story? This is how to put it in the second half of your paper."  
( $3 + 3 = 6$  is demonstrated).

"Turn the paper over and at the top edge of the paper put two seeds. Write the number 2 on the paper. Put four more seeds near the two at the top. How many are there at the top now? Write the story in the top half of the paper."

"Put one seed at the edge of the paper. Write the number 1. Put five more seeds next to the one. Write the story in the last half of your paper."



"Read all the stories. See if you can draw a picture for them. The first one will look like this."  
(Demonstrate).

$$\begin{array}{ccccccc} & 0 & 0 & 0 & 0 & 0 & \\ & & & & & & 0 \\ & & & & & & 1 \\ & 5 & & + & & & = 6 \end{array}$$

The papers when finished are similar to this:

$\begin{array}{ccccccc} & 0 & 0 & 0 & 0 & 0 & \\ & & & & & & 0 \\ & & & & & & 1 \\ & 5 & & + & & & = 6 \end{array}$	$\begin{array}{ccccccc} & 0 & 0 & & & 0 & 0 & 0 & 0 \\ & & & & & & & & \\ & 2 & & + & & 4 & & = 6 \end{array}$
$\begin{array}{ccccccc} & 0 & 0 & 0 & & 0 & 0 & 0 \\ & & & & & & & \\ & 3 & & + & 3 & & = 6 \end{array}$	$\begin{array}{ccccccc} & 0 & & & 0 & 0 & 0 & 0 & 0 \\ & & & & & & & & \\ & 1 & & + & & 5 & & = 6 \end{array}$

#### Lesson 42

##### Aim:

Review of use of ruler which is introduced in drawing classes, formation of numbers 1,2,3,4,5,6, and the sign " to indicate inches.

##### Materials:

Ruler

Paper and pencil

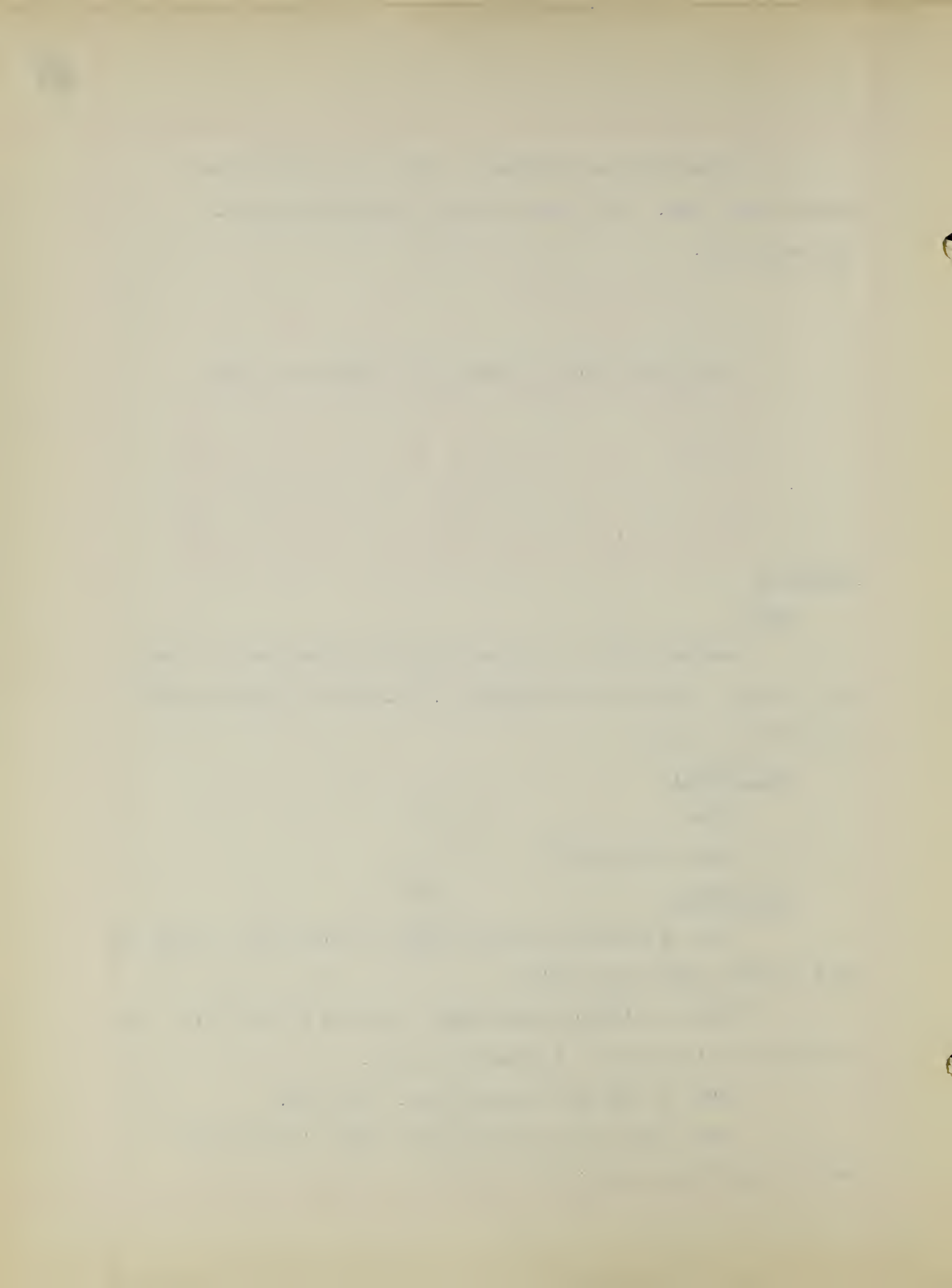
##### Procedure:

"See if you can make the edge of your ruler touch the edge of your paper like this."

"Make a line one inch long. How do we mark it? Yes, we write 1" like this." (Demonstrate 1").

"Make a line two inches long. Mark it."

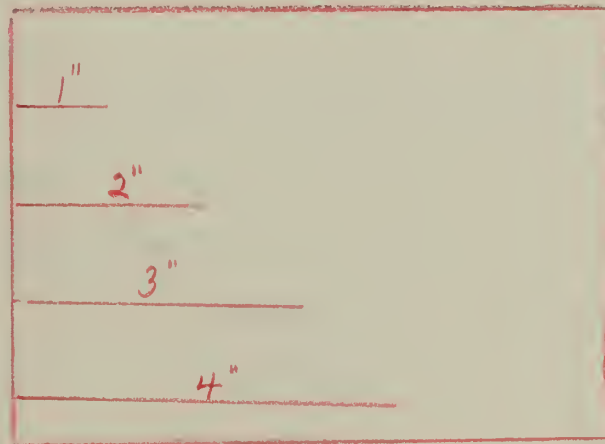
"The next line is going to be three inches long. Mark it after you make it."



"What do you think will be the number of inches for the next line? (Four). How many more inches do we have to make it than the one we just made? (One inch). Mark this one with 4" after you draw the line."

"What will the next line be? How much longer will it be than the line four inches long? (One inch). Draw this line and mark it."

"Draw a line six inches long and mark it. Which is the longest line? How many inches long is the shortest line?"







Lesson 43Aim:

To proceed from what is known about the number seven to systematic instruction in the meaning of number seven through the use of semi-concrete and concrete materials.

Materials:

Number boxes and oak tag cards

Procedure:

"When I say seven what do you think of? What does seven mean to you?"

Responses given:

7 baskets	7 cents	7 triangles
7 everything	7 circuses	7 bulls
7 stores	7 woofs	7 dolls
7 boxes	7 circles	7 o'clock
7 semi-circles	7 little windows in one big window	

After the above have been recorded children take their number boxes to follow these instructions:

"Take enough buttons from your box to make a row of seven. See if you can put the seven buttons in one long row. How can you make seven a different way. I can use six blocks and a chestnut and have seven things all together. See if you can make seven in a row in another way."



After this has been done the teacher illustrates at the board as individuals stand to tell the "story" of the way in which seven objects have been placed as:



Attention is directed to the oak tag cards. "Who can find the card with seven things on it? Is there another card with seven things on it? Find it. Which card has six things on it? Which is more, six or seven? Which card has the most on it? Find it."

"Here is the number 7. Where does it go on the number chart? (After 6). Who can name all the numbers on our number chart now?" (Put 7 on chart).



Lesson 44Aim:

To teach the formation of the number 7

Materials:

Paper and pencil

Procedure:

Teacher demonstrates at board saying, "To the right and down" as the two strokes are formed.

Children sky-write the number.

Children trace teacher's copy and then make 7 in remaining three parts of paper folded into fourths. (Note fourths).

Lesson 45Aim:

An understanding of addition through use of concrete materials and reproduction of facts by drawings.

Materials:

Beans

Pencil and paper

Procedure:

"Put six beans at the top edge of your paper. How do we write the number which tells how many beans there are?

(Check the formation of figure 7 made by the individual who goes to the blackboard). Put another bean near the six. How many are there all together? Who can go to the board and



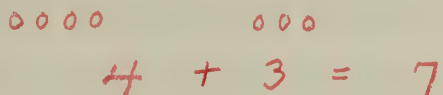
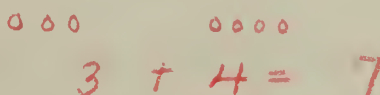




write the story?" ( $6 + 1 = 7$ ).

"Put five beans at the top edge of the paper. Write five in the bottom half of this paper. Put two more beans near the five. Now how many beans are there? Write the story on your paper like this." (Demonstrate  $5 + 2 = 7$ )

Continue in this manner for four and three are seven and three and four are seven. When the work with concrete objects is finished children draw pictures which tell the story of the numbers. Their finished papers are similar to these:

 $6 + 1 = 7$
 $5 + 2 = 7$
 $4 + 3 = 7$
 $3 + 4 = 7$



Lesson 46Aim:

An understanding of subtraction with number 7 through use of concrete materials and reproduction of facts by drawings.

Materials:

Acorns

Paper and pencil

Procedure:

With paper folded in half the acorns are arranged at the top edge of the paper as instructed:

"Put seven acorns at the top edge of your paper. Write the number 7 in the top box. Now take away one of the acorns. How many are left? Write the story like this. This is a new way to say take away.  $7 - 6 = 1$  This time the little sign = says leaves. Instead of writing out all the words we can use the signs that mean the same thing. Listen and then say it with me..." (As the teacher points to  $7 - 6 = 1$ , she says, "Seven take away six leaves 1").





"Now put seven acorns at the top edge of your paper again. Write the number 7 in the lower half of your paper. Take away two of the seven acorns. How many are left? Write the story which you have already started. Read the story."

"Turn the paper over and put the seven acorns at the top edge of it. This time take away three acorns. How many are left? Write the story like this. (Demonstrate).

The first part of the paper discusses the importance of the study and the objectives of the research. It also outlines the methodology used in the study and the results obtained. The second part of the paper discusses the implications of the study and the conclusions drawn from the research. It also outlines the limitations of the study and the areas for further research. The third part of the paper discusses the significance of the study and the contributions it makes to the field. It also outlines the practical applications of the study and the policy implications of the research. The fourth part of the paper discusses the future of the study and the potential for further research. It also outlines the challenges facing the study and the opportunities for future research. The fifth part of the paper discusses the overall findings of the study and the conclusions drawn from the research. It also outlines the implications of the study and the contributions it makes to the field. The sixth part of the paper discusses the significance of the study and the contributions it makes to the field. It also outlines the practical applications of the study and the policy implications of the research. The seventh part of the paper discusses the future of the study and the potential for further research. It also outlines the challenges facing the study and the opportunities for future research. The eighth part of the paper discusses the overall findings of the study and the conclusions drawn from the research. It also outlines the implications of the study and the contributions it makes to the field. The ninth part of the paper discusses the significance of the study and the contributions it makes to the field. It also outlines the practical applications of the study and the policy implications of the research. The tenth part of the paper discusses the future of the study and the potential for further research. It also outlines the challenges facing the study and the opportunities for future research.

Read the story."

"Put seven acorns at the top edge again and be ready to write a new story about seven in the lower half of this side of your paper. Take away four of the acorns from the seven acorns at the top of the paper. Now write the story. Read it. Now draw pictures for your stories." (Teacher demonstrates the first part of the paper and children work alone on the remainder of stories).

 $7 - 6 = 1$	 $7 - 4 = 3$
 $7 - 3 = 4$	 $7 - 2 = 5$

#### Lesson 47

##### Aim:

Numbers 1 to 7 in series--to review formation of these numbers 1, 2, 3, 4, 5, 6, 7.

To review number words one, two, three, four, five.

To review the symbols for triangle, oblong, square, semi-circle, circle.

##### Materials:

Paper and pencil

##### Procedure:

Children follow these written directions which are written on the blackboard.

THE  
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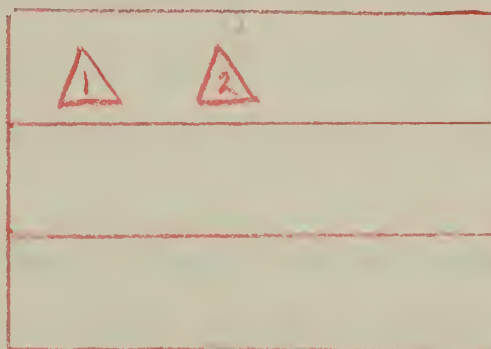
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Draw two 4 Number them
Draw three 1-3 Number them
Draw five 5 Number them

Draw four 4 Number them
Draw 6 6 Number them
Draw 7 7 Number them

The teacher discusses above directions and the children give names for designs to be drawn. The teacher explains terms "number them" and illustrates the first direction on paper.



#### Lesson 48

##### Aim:

To review formation of numbers 2, 3, 4, 5, 6, 7

To write the correct number for the sounds heard  
or the number of bounces of a ball.

##### Materials:

Ball

Bell to tap

Paper and pencil

##### Procedure:

As the teacher bounces a ball individuals are called to the board to write the number to check for correct formation.



As paper is passed children fold it into halves.

"How could we make the paper have four oblongs on each side? Yes, fold it this way. (Demonstrate). How many oblongs are there now? Each time I bounce the ball you will write the number of times in an oblong. Where is the first oblong? Point to the second oblong. Yes, it is at the top and at the right."

"Write the number of times I bounce the ball in the first oblong. Ready, watch." (Bounce five times). (Demonstrate on paper in the first space the number 5).

"Write the next number in the second oblong." (Bounce seven times).

"Where is the third oblong? Put the next number there." (Bounce ball four times. Finish bouncing with six bounces).

"On the other side you will write the number of times you hear me tap the bell. You must listen carefully for you cannot see me tap it. (Tap 2, 4, 6, and 7 times).

Check all papers at close of lesson for correct formation of numbers and give individual help where required.

the following: (1) the physician's duty to his patient; (2) the physician's duty to his fellow physicians; (3) the physician's duty to his community; (4) the physician's duty to his profession; (5) the physician's duty to his country; (6) the physician's duty to his race; (7) the physician's duty to his religion; (8) the physician's duty to his family; (9) the physician's duty to his neighbors; (10) the physician's duty to his society; (11) the physician's duty to his world; (12) the physician's duty to his God.

The physician's duty to his patient is the most important of all. It is the duty of the physician to do no harm to his patient, to relieve his suffering, and to promote his health. This duty is the foundation of the physician's profession, and it is the duty that the physician must always keep in mind.

The physician's duty to his fellow physicians is also important. It is the duty of the physician to cooperate with his fellow physicians, to share his knowledge, and to help them in their work. This duty is the basis of the physician's profession, and it is the duty that the physician must always keep in mind.

The physician's duty to his community is also important. It is the duty of the physician to serve his community, to promote its health, and to prevent disease. This duty is the basis of the physician's profession, and it is the duty that the physician must always keep in mind.

The physician's duty to his profession is also important. It is the duty of the physician to maintain the standards of his profession, to uphold its honor, and to promote its interests. This duty is the basis of the physician's profession, and it is the duty that the physician must always keep in mind.

Lesson 49Aim:

Interpretation of symbols and an understanding of subtraction through the reproduction by drawings.

Materials:

Paper and pencil

Procedure:

Following directions from blackboard:

Draw 4. Take away 3.		Draw 4. Take away 1.	
Draw 5. Take away 4.		Draw 5. Take away 1.	
Draw 7. Take away 6.		Draw 7. Take away 2.	
Draw 6. Take away 5.		Draw 6. Take away 1.	

<del>X</del> <del>X</del> <del>X</del> ○	1	<del>X</del> ○ ○ ○	3
<del>X</del> <del>X</del> <del>X</del> <del>X</del> ○	1	<del>X</del> ○ ○ ○ ○	4
<del>X</del> <del>X</del> <del>X</del> <del>X</del> <del>X</del> ○	1	<del>X</del> ○ ○ ○ ○ ○ ○	6
<del>X</del> <del>X</del> <del>X</del> <del>X</del> <del>X</del> <del>X</del> ○	1	<del>X</del> ○ ○ ○ ○ ○	5





Lesson 50Aim:

To proceed from what is known about the meaning of number 8 to instruction in the meaning of number 8 through the use of concrete and semi-concrete materials.

Materials:

Number boxes

Oak tag pictures with colored objects

Procedure:

The teacher asks, "What do you think of when I say eight? What does eight mean to you?"

Responses:

8 schools	8 years old	8 butterflies
8 things	8 pictures	4 and 4 are 8
8 bricks	8 mailmen	4 popsicles with 8 halves
8 nails	8 designs on paper	4 windows broken in halves
4 tomatoes cut in halves	a big paper folded in eighths	

When all the responses have been given eight children are tapped on the shoulder. These are to go to the front of the room.

"How many children are at the front of the room? (8). How did you know? (I counted). Show us. (Counted by ones). Does anyone know another way to count them?" (Another counted, "Two, four, six, eight"). (This was knowledge possessed by the child and knowledge not gained through classroom instruction)

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

$$\frac{dx}{dt} = f(x, y, z), \quad \frac{dy}{dt} = g(x, y, z), \quad \frac{dz}{dt} = h(x, y, z),$$

where  $f, g, h$  are continuous functions of  $x, y, z$  and satisfy certain conditions.

2. In the second part we consider the case when the functions  $f, g, h$  are linear in  $x, y, z$ .

3. The third part is devoted to the study of the stability of the solutions of the system of equations.

$$\frac{dx}{dt} = -x, \quad \frac{dy}{dt} = -y, \quad \frac{dz}{dt} = -z,$$

and show that the solutions of this system are stable.

4. In the fourth part we consider the case when the functions  $f, g, h$  are nonlinear in  $x, y, z$ .

5. The fifth part is devoted to the study of the stability of the solutions of the system of equations.

$$\frac{dx}{dt} = x^2 + y^2 + z^2, \quad \frac{dy}{dt} = x^2 + y^2 + z^2, \quad \frac{dz}{dt} = x^2 + y^2 + z^2,$$

and show that the solutions of this system are unstable.

6. In the sixth part we consider the case when the functions  $f, g, h$  are nonlinear in  $x, y, z$ .

7. The seventh part is devoted to the study of the stability of the solutions of the system of equations.

8. In the eighth part we consider the case when the functions  $f, g, h$  are nonlinear in  $x, y, z$ .

9. The ninth part is devoted to the study of the stability of the solutions of the system of equations.

"Find the card with eight pictures on it. Which one has seven? Which one has the most?"

"From your number box take things to make eight in a row. See how many different ways you can make eight."

The teacher lists at board and class count to see if total is eight. The teacher writes the numbers under pictures of the objects and then writes the total eight.

△ △ △ △      ○ ○ ○ ○  
4                      4                      8

8 8 8      0 0 0 0 0      8  
3                      5                      8

### Lesson 51

#### Aim:

To teach the formation of number 8

#### Materials:

Paper folded with 8 made by the teacher

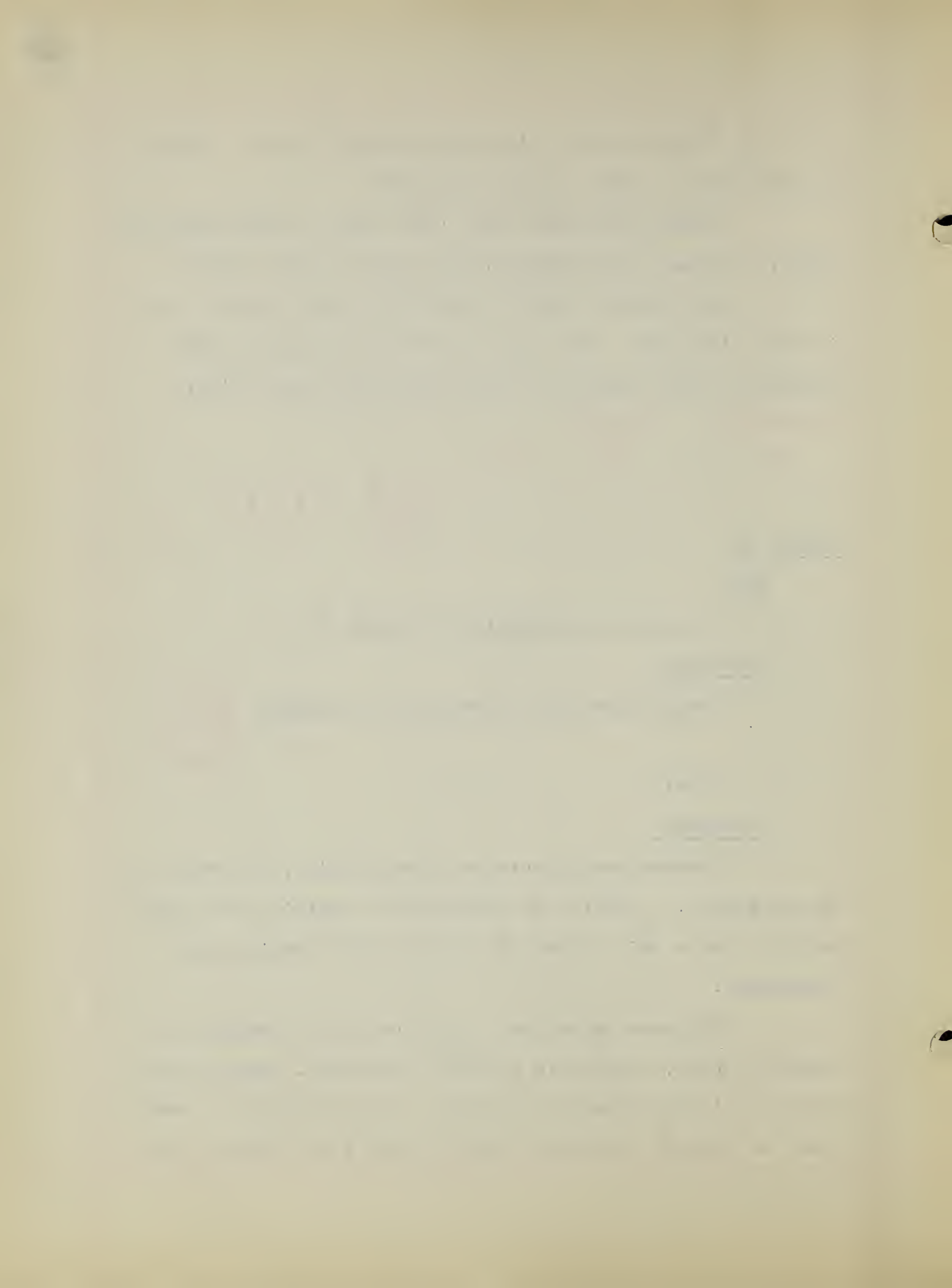


Pencil

#### Procedure:

Teacher demonstrates at board saying, "We make c, s and finally 8." (Since the children are familiar with manuscript c and s this is said to try to avoid forming the 8 backwards).

Children sky-write 8 and then after tracing the teacher's copy, they write 8 three more times. Each writes the eight in the teacher's presence. As she stands at each desk the teacher checks the formation of 8 and records the



names of those needing extra help to be given in another period.

## Lesson 52

### Aim:

An understanding of addition through the use of concrete materials and reproduction of number facts by drawings.

### Materials:

Pipe cleaners

Pencil and paper

### Procedure:

After papers are folded into halves, six pipe cleaners are arranged at the edge of the paper at the top and the children write the number six.


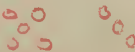
"Put two more pipe cleaners at the top. Now how many are there? Write the story  $6 + 2 = 8$



"Put five pipe cleaners at the top. Put three more near them. What is the story? Write it." (Turn paper over.)

"Put two pipe cleaners at the top. Put six more near them. What is the story? Write it."

"Put three pipe cleaners at the top. Put five more near them. What is the story? Write it."

Children illustrate the above stories and each paper is checked as it is finished.

$6 + 2 = 8$ 
$5 + 3 = 8$ 

$2 + 6 = 8$ 
$3 + 5 = 8$ 





Lesson 53Aim:

An understanding of term another and an understanding of addition of another item increasing a series by one.

Materials:

Paper folded as in diagram

Pencil

Procedure:

The children follow these board directions after first item is explained by the teacher, "In the first space I put one circle and write 1. In the second space I draw another as the directions tell me. In the third space I write 2 like this. See if you can follow these directions."

1○	Draw another
2△	Draw another
3□	Draw another
4◡	Draw another

5□	Draw another
6△	Draw another
7○	Draw another
8◡	Draw another

The papers should be finished in this manner:

○	○ 2	□ □ □ □ □ □ □	□ 6
△ △	△ 3	△ △ △ △ △	△ 7
□ □ □	□ 4	○ ○ ○ ○ ○ ○ ○	○ 8
◡ ◡ ◡ ◡ ◡	◡ 5	▽ ▽ ▽ ▽ ▽ ▽ ▽	▽ 6



Lesson 54Aim:

To show addition of two to 2, 4, 3, 1, 5 and 6

Materials:

Semi-circles cut from colored paper

Pencil and paper

Procedure:

"Put two semi-circles at the top of your paper. Write the number 2 on your paper. Pick up two more semi-circles and put them near the first two. How many are there now? How do you write that? Yes,  $2 + 2 = 4$ ."

"Put four semi-circles at the top edge of the paper. In the second box on your paper write the number 4. Put two more semi-circles near the other semi-circles. Now how many semi-circles are there? How would you write the story? Write it in the second box where you have already started your story."

"Put three semi-circles at the top edge of your paper. Put two more near them. What is the story? Write it in the last box on the paper. Show me the first box on the other side of your paper. Put one semi-circle at the top edge of the paper. Put two more. Write the story." (Proceed in similar fashion as five plus two and six plus two are developed. Children draw pictures of stories made on paper.)



Lesson 55Aim:

An understanding of the fact that interchanging the position of numbers does not change the sum.

Materials:

Beans

Paper and pencil

Procedure:

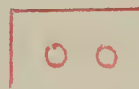
"Put four beans at the top edge of your paper. Write the number 4 and put four more beans near the first four. Write the story."

"Put six beans at the edge and write the number 6. Put two more beside the six beans. What is the story? Write it. If you started with the two what would the story be? Write that story. Read both." ( $6 + 2 = 8$ ,  $2 + 6 = 8$ )

"When you draw the picture for this story, make it like this:"



6



2

"Put seven beans at the top of the paper. Put another one near them. How many are there now? What is the story? Yes, we can say 1 and 7 are 8. Write the story. Read the two stories you wrote in this box."

"After you turn over your paper put five beans at the top edge. Put two more beans near them. What is the story? Write it. How else can you write the story? Read

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental procedures and the statistical analysis performed.

3. The third part of the document presents the results of the study. It includes a series of tables and graphs that illustrate the findings of the research. The data shows a clear trend of increasing activity over time.

4. The fourth part of the document discusses the implications of the findings. It suggests that the results have significant implications for the field of study and may lead to further research in this area.

5. The fifth part of the document concludes the study. It summarizes the main findings and provides a final statement on the importance of the research.



both stories."

"In the last box on the paper write the number 4 and put four beans at the top edge of the paper. Put three more beans near the four. How many are there now? Tell the story. Write it. What other way can you tell the same story? Write it. Read both stories."

Children illustrate the above stories.

### Lesson 56

#### Aim:

Review of numbers 2, 3, 4, 5 and addition with these numbers.

#### Materials:

Paper and pencil

#### Procedure:

After teacher explains the first item in the directions, children follow printed directions to put the correct number of objects in the given boxes:

2	4	
4	2	
3	2	
2	3	

3	4	
4	3	
2	5	
5	2	

The finished papers look like this:

2	4	6
4	2	6
3	2	5
2	3	5

3	4	7
4	3	7
2	5	7
5	2	7



Lesson 5 7Aim:

An understanding of subtraction through the use of concrete materials.

Materials:

Colored circles of paper

Procedure:

"Put eight circles before you. Pretend you have eight pennies there instead of eight circles. If you spend four of those pennies how many will be left? Take away four of the circles and see."

"Now pretend you spend two of those pennies (Eight). How many would be left then? (Six). How many will you have to take away if you pretend to spend five pennies? How many would be left if you spend one?"

Children tell "stories" of above as, "I have eight pennies and I spend four. Then I shall have only four pennies."



Lesson 58Aim:

An understanding of subtraction through the use of concrete materials.

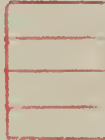
Materials:

Pumpkin seeds

Paper and pencils

Procedure:

"Fold your paper like this. (Demonstrate as in diagram).



"Now how many parts did you fold it into? Put three seeds at the top edge of your paper. Write three on your paper. Take away <sup>one</sup> pumpkin seed. How many are left? How will you write that on your paper? Read it. Put the three seeds back at the top edge of the paper. Now take away two seeds. How will you write that story?"

Repeat above for 4 take away 1

4 take away 3

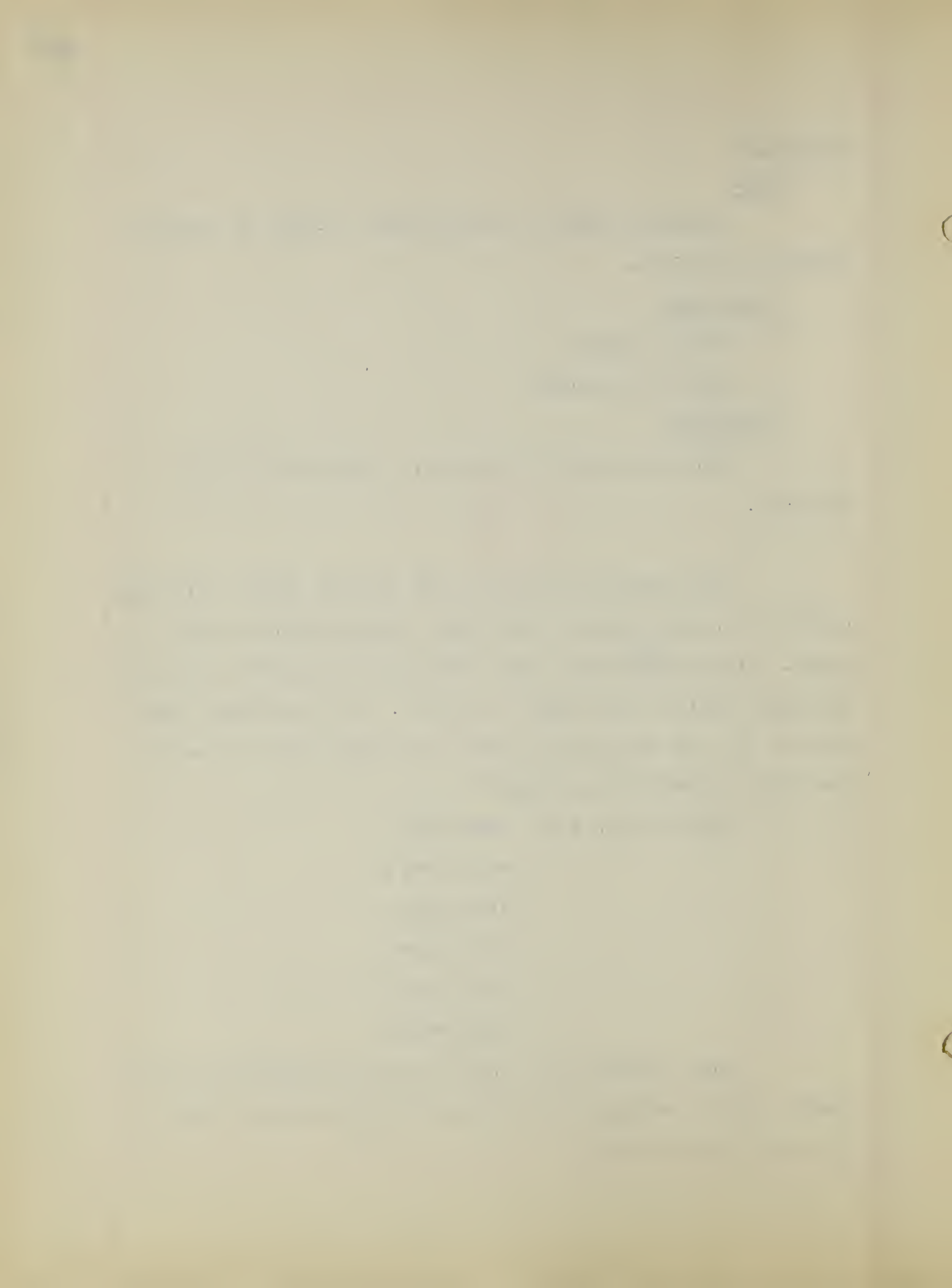
5 take away 1

5 take away 4

5 take away 2

5 take away 3

When the work with seeds has been completed and the number stories written the children are instructed to draw pictures of the stories.





Lesson 59Aim:

To proceed from what is known about the number nine to systematic instruction in the meaning of that number through the use of semi-concrete and concrete materials.

Materials:

Number boxes

Oak tag with colored pictures

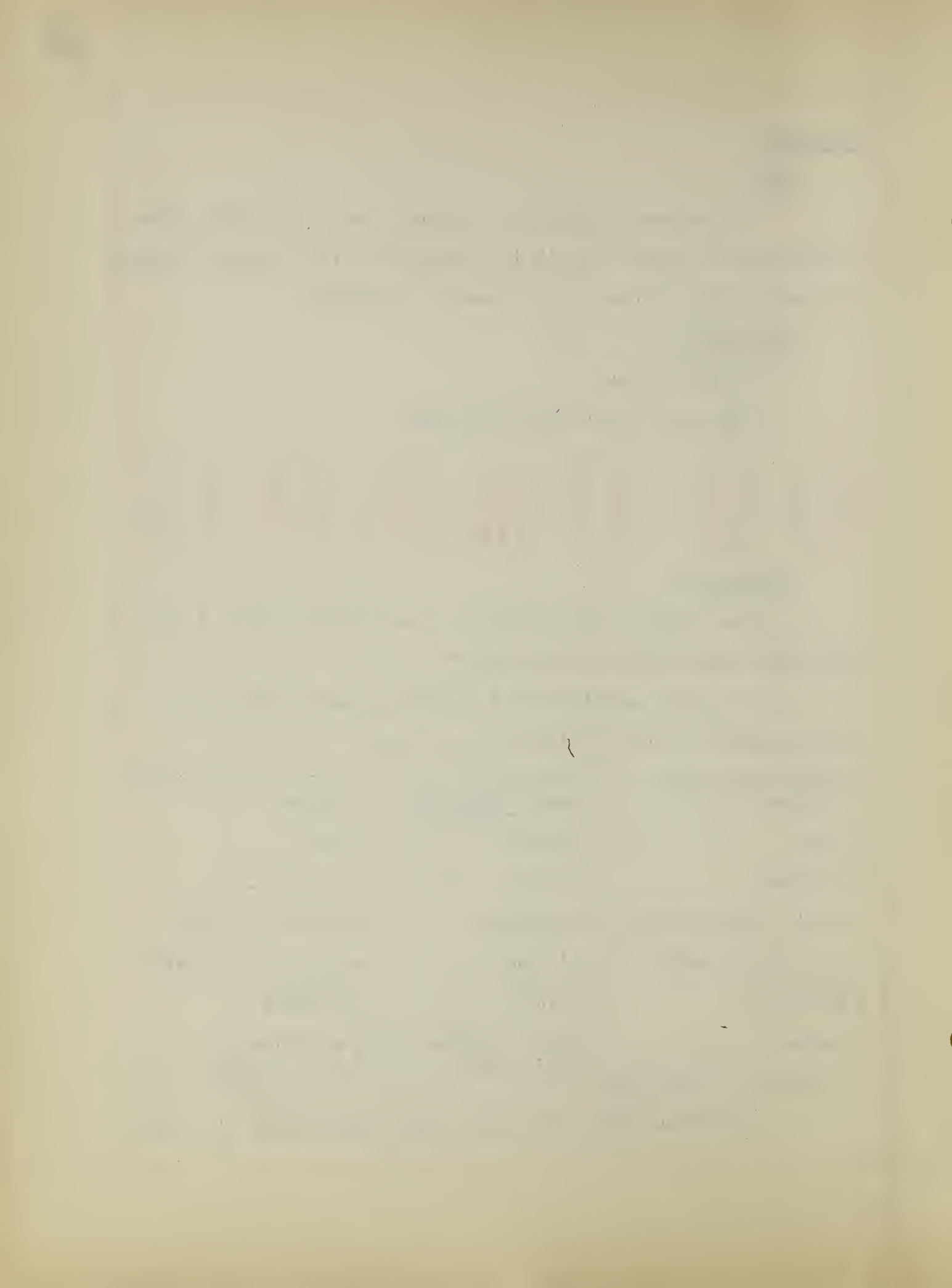
Procedure:

The teacher asks, "What do you think of when I say nine? What does nine mean to you?"

To this question the following answers were made and recorded as the individuals gave them:

1 mother cat and 8 babies	9 letters on the word <u>afternoon</u>	1 skinny book with 9 pages
9 pigs	9 schools	9 toys
9 ribbons	9 books	9 years old
1 tulip and 9 petals	9 skeletons	9 pairs of shoes
9 pieces of candy	9 o'clock	9 teeth in a mouth
9 glasses	9 trucks	9 baskets
9 desks	9 little windows in 9 shingles a big one	
1 duck and 8 ducklings		

When the above have been given the teacher taps nine



children. Each goes to the front of the room and the teacher asks, "How many children do you see here? How did you find out there were nine?"

The answer given was, "I counted" and he indicated his counting one by one. Another child showed that he counted by twos and added one to make nine as, "I said, two, four, six, eight and nine." Another indicated another way, "Three, six, nine."

As the oak tag cards are put in view the teacher asks, "How many pictures do you see here? Which one has eight things in it? Which one has more than eight? How many are on the card with more than eight? Is there another card with nine things on it? Where is the card with five things? Where is the card with two things? Find the card with seven things. Who can find the card with six things."

When directions have been followed to take the number boxes the children proceed under these instructions:

"See if you can make a long row with nine things in it. Let us see the different ways of making nine."

As individuals tell the story of the way in which nine objects are placed in the row, the teacher illustrates on the board in this manner:



All the children count to see if the total for each of the above arrangements is nine.



Lesson 60Aim:

To teach the correct formation of the number 9

Materials:

Paper folded into fourths with the number 9 formed by the teacher in the upper right box

Pencils

Procedure:

Teacher demonstrates at the board.

Children do sky-writing of the number 9 in the air following the teacher as she forms the number 9 on the black-board.

Teacher checks each paper as each child traces the teacher's number and then makes a 9 in each of the remaining boxes. Those needing extra help are given it at the time.

Lesson 61Aim:

To review numbers in series

To review formation of numbers 1 to 9

Materials:

Paper and pencil

Procedure:

Children follow directions written on board after following directions to fold papers in halves.

Draw 9 boats  
Number them

Draw 9 balls  
Number them

Draw 9 balloons  
Number them

Draw 9 bells  
Number them





Lesson 62Aim:

An understanding of addition through concrete materials.

Materials:

Paper and pencils

Number boxes

Beans

Procedure:

"Fold your paper in fourths like this:"



"Put four beans at the top edge of the paper. Write the number 4. Put five more beans at the top. How many are there now? Write the story."

"Put eight beans at the top edge of your paper. Put one more near them. How many are there all together? What is the story? Write it. Read it."

"Put two beans at the top edge of the paper. Put seven beans near them. What is the story now? Write it. Read it."

"What box are we going to put the next story in? (Fourth). Put five beans at the top. Put four more near them. What is the story? Write it."

Proceed as above for ~~six~~ and three, three and six. Children illustrate above stories as follow-up work at seats.



Lesson 63Aim:

An understanding of subtraction through the use of concrete materials and reproduction of addition facts by drawing.

Materials:

Buttons

Paper and pencil

Procedure:

"Fold your paper in halves. Put nine buttons at the top edge of the paper. Write the number 9 in the top half of the paper. Be certain your number looks like this.. (Demonstrate at the blackboard the correct formation as a review). Take away one of those buttons. How many are left? How would you tell the story? Write the story which you have already started in the top box. Read the story."

"Put nine buttons at the top again. This time take away three. How many are left? What is the story? Write it. Read it."

"Put nine buttons at the top again. In what half of the paper will this story go? (The last half). Put nine buttons at the top and from them take four buttons. How many are left? How will you write the story? Yes, 9 take away 4 leaves 5."

Children illustrate the above number stories. The finished paper look like diagram on next page.





$$9 - 1 = 8$$



$$9 - 2 = 7$$



$$9 - 3 = 6$$



$$9 - 4 = 5$$





Lesson 64Aim:

An understanding of addition facts through reproduction by drawings.


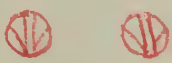
Materials:

Paper and pencil

Procedure:

Children follow directions as in diagram after the teacher illustrates the first step.

"The first number is 4 so I put four balls. The next number in this row is 2 so I put two balls. In the last box in the row I put the number which tells all the balls I drew."

 4	 2	6
4	3	
5	3	
6	2	

6	3	
5	4	
3	6	
3	5	



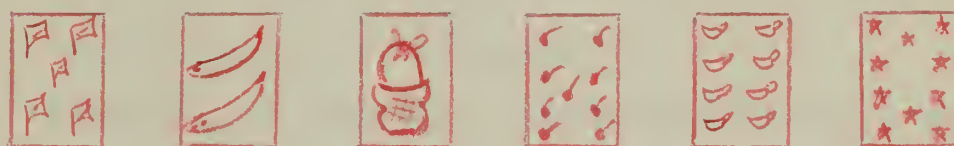
Lesson 65Aim:

To begin systematic instruction in the meaning of 10 through the use of concrete materials.

Materials:

Number boxes

Oak tag cards with colored pictures

Procedure:

When the number boxes have been taken out the children put ten objects in a row as instructed.

"Let us see how many different ways we have to put together ten things." Teacher illustrates these at the board and the class count to see if the total is ten for each grouping. At this point the teacher shows that it is not necessary to start at one to find the number of all the objects. For example, in the following grouping of pegs,

'' '' '' '' '' '' '' ''  
2

the counting may begin with the first two and proceed up to ten.

"We see there are two here so we say, 'Two, three, four, five, six, seven, eight, nine, ten.'"

When the next grouping is given the teacher explains it also. "This row starts with three pegs. We can see there



are three without starting to count from one so we start with three and then say four, five, six, seven, eight, nine, ten."

(Teacher demonstrates this in the following drawing:

3      11)

After five or six ways of putting ten objects in a row are explained, attention is directed to the oak tag cards.

"Which card has the most on it? How many are there? Yes, there are ten. Where is the card with two? Where is the card with eight? Which card has nine?"

"Here is the number 10. Where will it go on the number chart? Read all the numbers on our chart. Which is the first? Which is the last number on this chart?

## Lesson 66

Aim:

To teach the correct formation of the number 10.

Materials:

Arithmetic paper folded in fourths with teacher's 10 made in the upper right box.

Procedure:

Teacher demonstrates at the board.

Children sky-write the number 10, following the lines as the teacher makes them on the board. Children trace the teacher's copy and go on to the remaining boxes as the teacher checks each paper and gives help where necessary.





Lesson 67Aim:

An understanding of addition through the use of concrete materials.

Materials:

Beans

Paper and pencil

Procedure:

"Fold your paper in fourths. Put five beans at the top edge of the paper. Put five more near them. How many are there all together? What is the story? Write it."

"Put six beans at the top edge of the paper. Four more near them. How many are there all together? What is the story? Write it. Read the story."

"Put seven beans at the top of the paper. Put three beans near them. How many are there all together? What is the story? Write it."

"Now put eight beans at the top edge of the paper. Put two more beans near them. How many are there all together? Write the story."

$5 + 5 = 10$
$6 + 4 = 10$

$7 + 3 = 10$
$8 + 2 = 10$

After this work with concrete materials children illustrate the number stories on their papers.



Lesson 68Aim:

An understanding of subtraction

Materials:

Acorns

Paper and pencil

Procedure:

"Fold your paper in fourths like this. (Demonstrate). Put ten acorns at the top edge of your paper. Take away six. How many are left? What is the story? Write the story. Put ten acorns at the top edge of your paper again. Take away nine. How many are left? How do we write the story? Write it.  $(10 - 9 = 1)$  Read it."

"Put ten acorns at the top again. This time take away seven. How many are left? What is the story? Write it.  $(10 - 7 = 3)$  Read it."

"Put the ten acorns at the top again. Take away two. How many are left? Write the story."  $(10 - 2 = 8)$

"Put ten acorns at the top. Take away five. How many are left? What is the story? Write it."  $(10 - 5 = 5)$

"Read all the stories. Now see if you can draw the pictures to go with the number stories on your paper."

The papers when finished look like this:

$10 - 6 = 4$   
 $10 - 9 = 1$   
 $10 - 7 = 3$   
 $10 - 2 = 8$

$10 - 5 = 5$



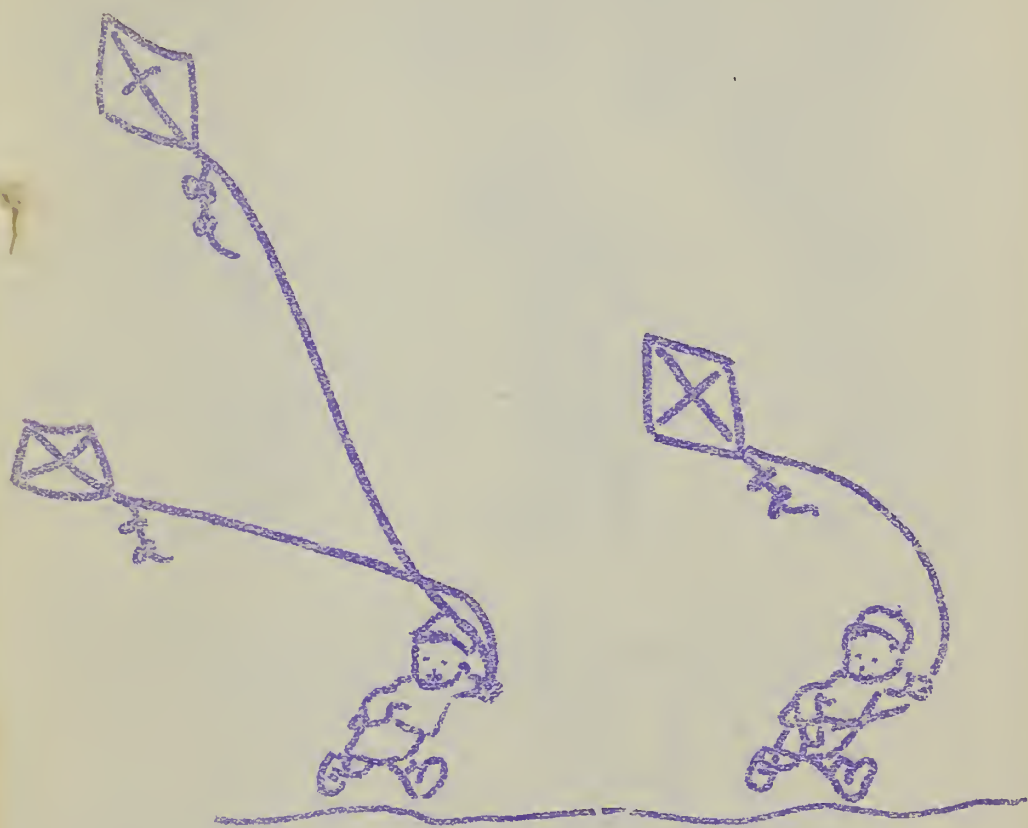
APPENDIX B  
ORIGINAL ARITHMETIC READINESS TEST  
WITH DIRECTIONS FOR  
ADMINISTERING AND SCORING

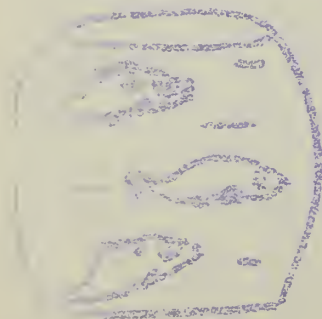
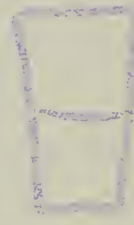
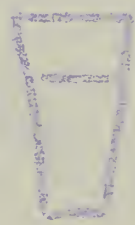
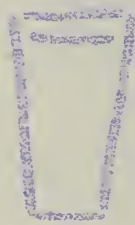
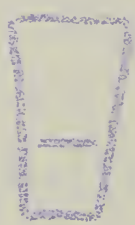
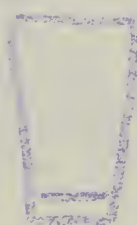


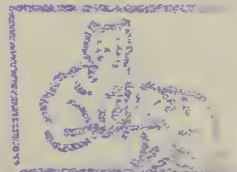
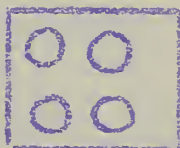


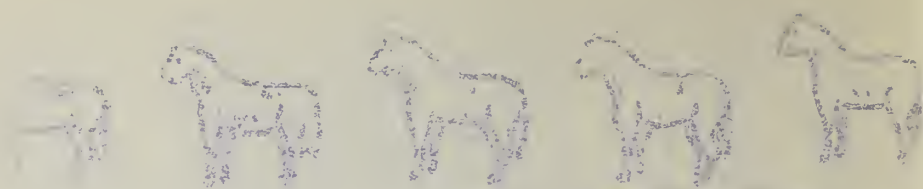




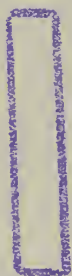
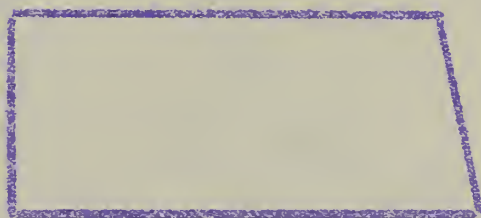
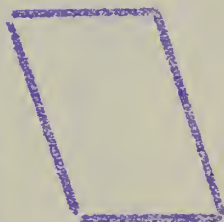
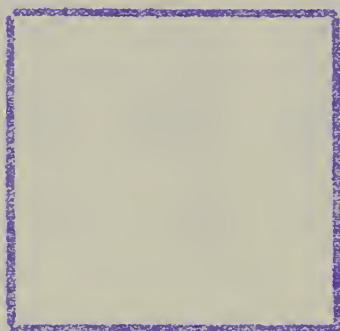


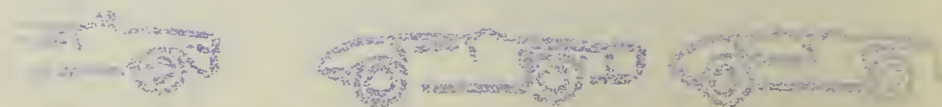
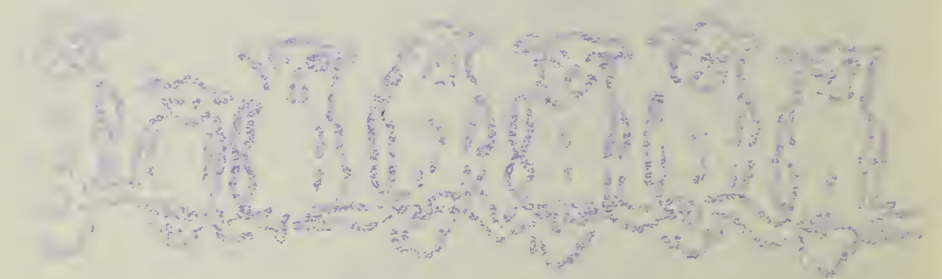
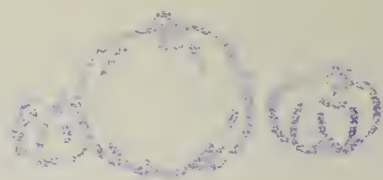




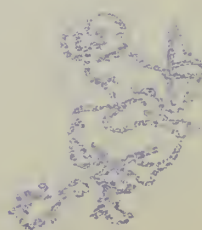
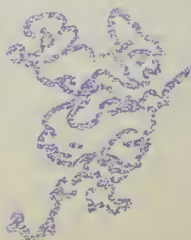
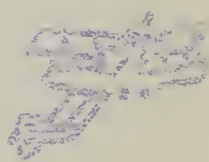
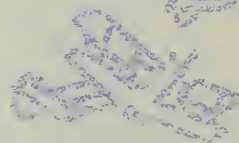
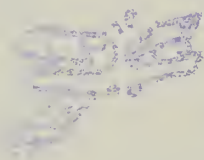
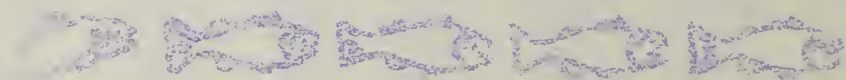
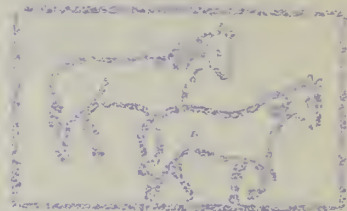
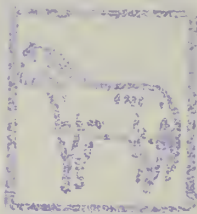


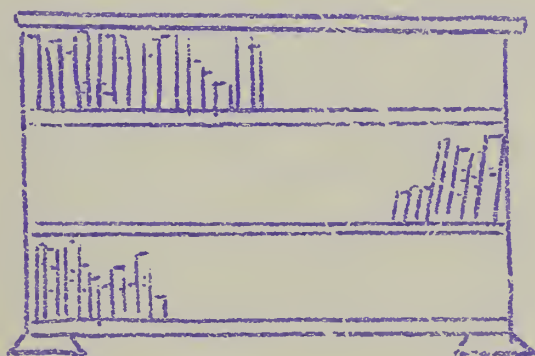


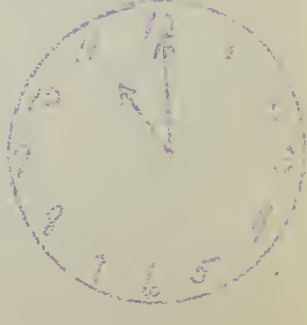
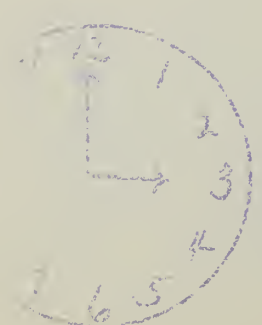
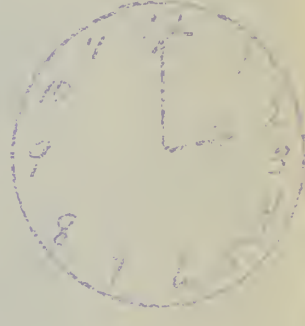
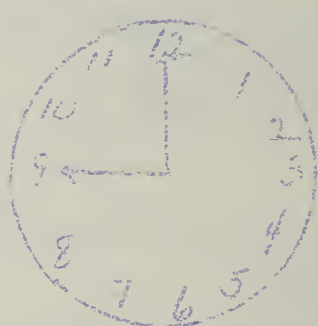
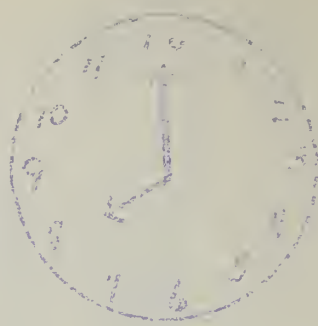




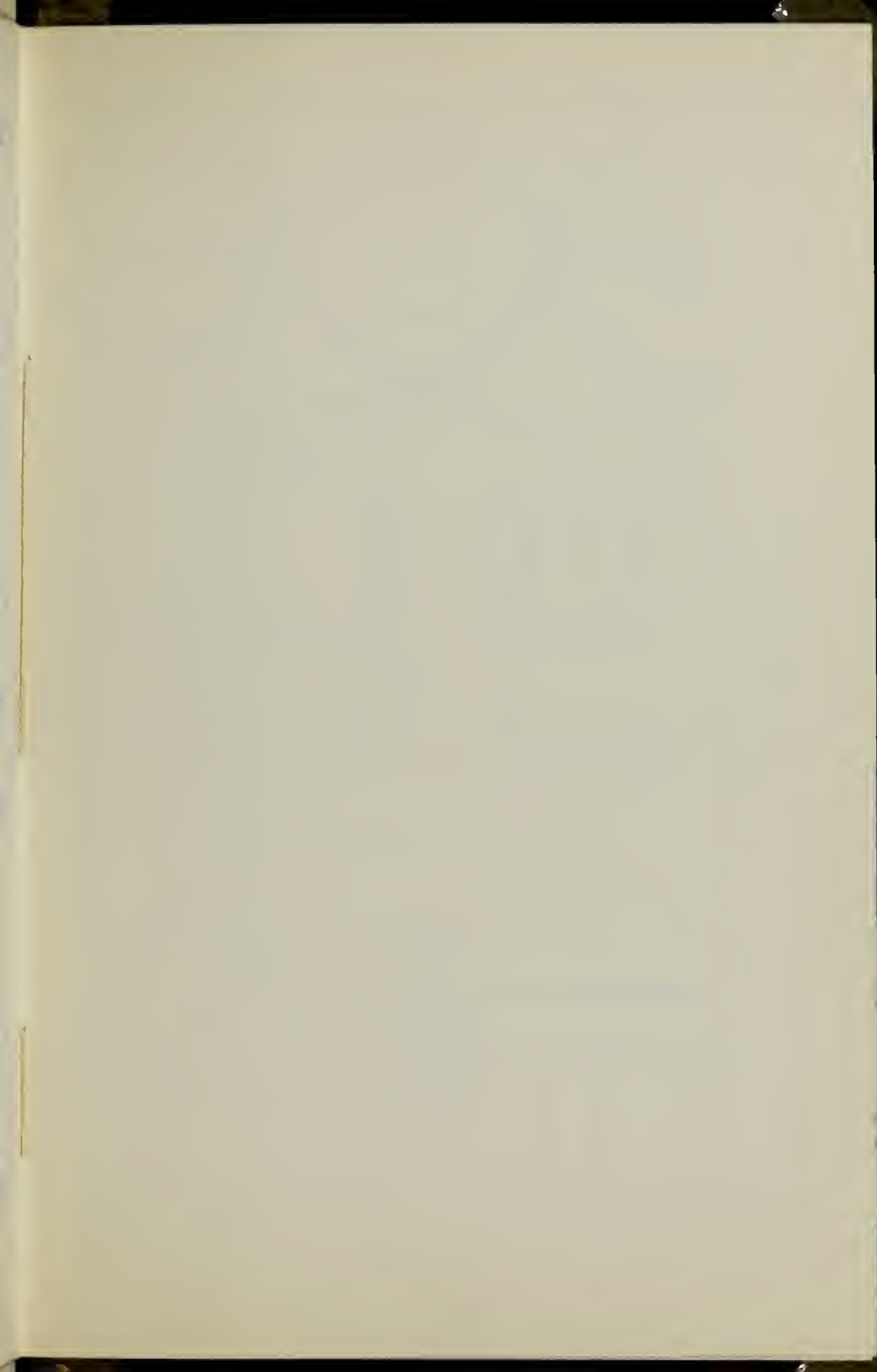


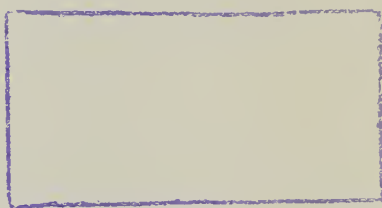
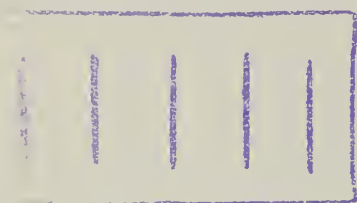
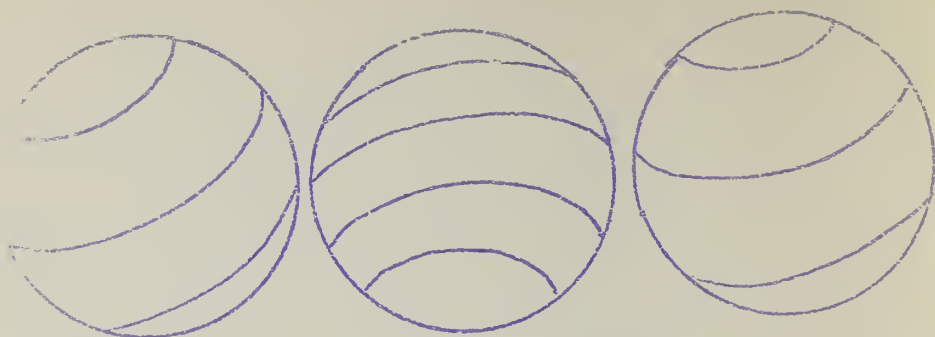


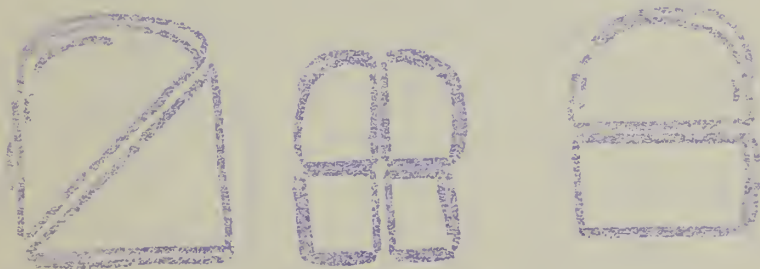
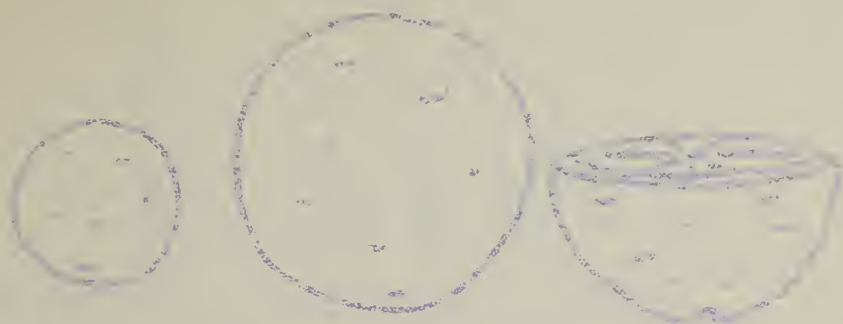


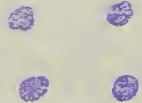
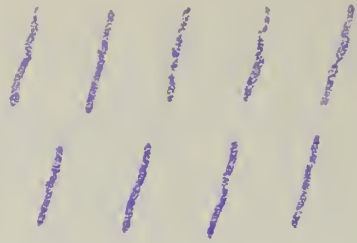
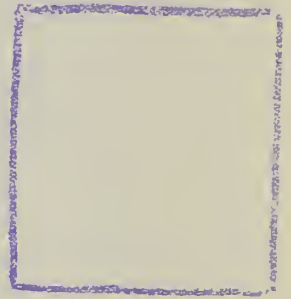












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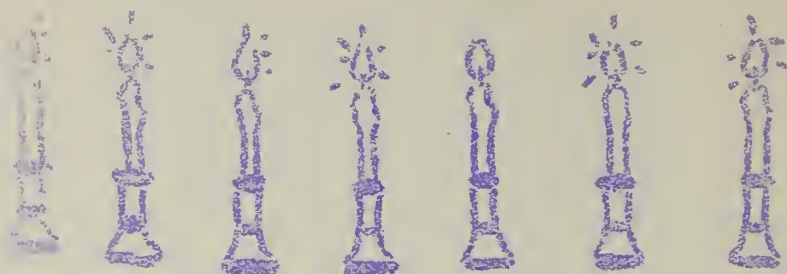
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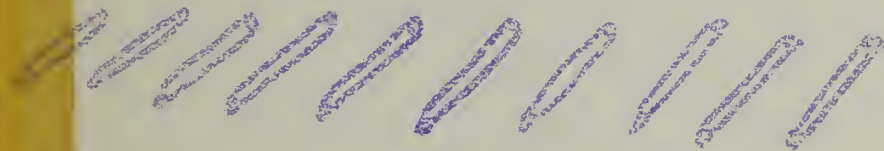
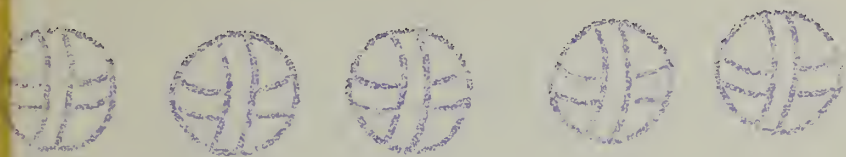
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DIRECTIONS FOR ADMINISTERING AND SCORING  
THE ARITHMETIC READINESS TEST

Each child is equipped with a crayon and a test booklet and is seated comfortably within sight and hearing of the person administering the test.

Fifteen seconds are allotted for each item of the test.

The following directions are read as the test is administered:

"We are going to play some games with the pictures in these books. Listen and do everything I tell you. Do not mind if you cannot do everything but do the best you can. Put a mark everywhere I tell you!"

"Fold your books over so you see two little boys with kites. See the two little boys with kites. One little boy has only one kite. Mark the little boy with one kite. Mark it like this." (Demonstrate at the blackboard or on a test booklet.)

"Mark the highest kite."

"Fold your books back so you see a man with balloons."

Page A

Item 1. See the three balloon men. Mark the man with the most balloons.

Item 2. See the glasses of milk. Mark the glass with the most milk.



Item 3. See the fish bowls. Mark the bowl with the most fish.

"Fold your books over so you see the pictures of pigs."

Page B

Item 1. See the pictures of the pigs. Mark the picture of the three little pigs.

Item 2. See the boxes with the balls. Mark the box with one ball.

Item 3. See the cakes. Mark the cake with five candles.

Item 4. See the picture of kittens. Mark the two kittens.

"Fold your book back so you see some horses."

Page C

Item 1. See the horses. Mark the third horse.

Item 2. See the dogs. Mark the second dog.

Item 3. See the ducks. Mark the fifth duck.

Item 4. See the birds. Mark the fourth bird.

Item 5. See the bunnies. Mark the first bunny.

"Turn your book over so you see some blocks."

Page D

Item 1. See these pretty designs. (Indicate).  
Mark the circle.

Item 2. See these blocks. (Point to second row).  
Mark the square.





Item 3. See these blocks. (Point to third row).

Mark the triangle.

Item 4. See these designs. (Indicate fourth row).

Mark the semi-circle.

"Fold your books back so you see some pumpkins."

Page E.

Item 1. See the pumpkins. Mark the biggest pumpkin.

Item 2. See the cats. Mark the largest cat.

Item 3. See the pigs. Mark the biggest pig.

Item 4. See the owls. Mark the smallest owl.

Item 5. See the cars. Mark the longest car.

"Turn over so you see some houses."

Page F

Item 1. See the houses. Mark the middle house.

Item 2. See all the soldiers. (Point to all).

Mark the soldiers in a row.

Item 3. See the girls down here. (Indicate).

Mark the girls who are partners.

"Turn back the page and fold over your books so you see some stars."

Page G

Item 1. See the stars. Mark the star with the circle around it.

Item 2. See the fish. Mark the fish that is different.

See the planes. Mark the plane up highest.



Item 3. See the pictures of horses. Mark the horse standing alone.

Item 4. See the witches. Mark the lowest witch.

"Turn over so you see a pony."

Page H

Item 1. See the pony. Put a mark under the pony.

Item 2. See the shelves. Mark the bottom shelf.

Item 3. See the tree. Put a mark at the top of the tree.

"Turn over the page and fold your books back so you see some clocks."

Page I

Item 1. See the clocks up here. (Indicate).

Mark the clock that says 8 o'clock.

Item 2. See these clocks. (Indicate).

Mark the clock that says 5 o'clock.

Item 3. See these clocks. (Indicate).

Mark the clock that says 11 o'clock.

Rest here if necessary. "Now let us look on the next page."

Page J

Item 1. This is a new game. Put three marks at the top.

Item 2. Put one mark at the bottom.

Item 3. Put two marks in the middle.

"Turn over so you see some balls."



Page K

- Item 1. You will put more than one mark here. Mark the balls that have the same number of lines.
- Item 2. See these boxes. (Indicate). Make this empty box (indicate) have the same number of sticks as this one. (Indicate box with sticks).
- Item 3. See this box. (Indicate whole space). In this place put enough sticks for eight lollipops.
- Item 4. See the pieces of paper. Six children needed paper. Mark how many the teacher must pass.

"Turn over so you see cookies."

Page L

- Item 1. See the oranges here. (Indicate). Mark the orange cut in half.
- Item 2. See the cookies. Two children each ate one cookie. Mark how many each ate.
- Item 3. See the sandwiches. Mark the sandwich cut in quarters.

"Turn over so you see some sticks."

Page M

- Item 1. In this box (indicate) you will write a number. Count these sticks (indicate) to

1. The first part of the paper discusses the importance of the study.

2. The second part of the paper discusses the methodology used in the study.

3. The third part of the paper discusses the results of the study.

4. The fourth part of the paper discusses the conclusions of the study.

5. The fifth part of the paper discusses the implications of the study.

6. The sixth part of the paper discusses the limitations of the study.

7. The seventh part of the paper discusses the future research.

8. The eighth part of the paper discusses the acknowledgments.

9. The ninth part of the paper discusses the references.

10. The tenth part of the paper discusses the appendices.

11. The eleventh part of the paper discusses the index.

12. The twelfth part of the paper discusses the glossary.



yourself. Then write the number that tells how many sticks you counted.

Item 2. Count these sticks to yourself. (Indicate sticks). Write the number here. (Indicate box).

Item 3. Count these dots. (Indicate). Write the number here. (Indicate).

Item 4. Count these dots. (Indicate). Write the number here. (Indicate).

"Turn over so you see numbers."

Page N

Item 1. What is this number up here? Yes, it is two. Put two sticks near it.

Item 2. Do not tell this number (indicate) but put the right number of sticks near it.

Item 3. Do not tell this number (indicate) but put the right number of sticks near it.

Item 4. Do not tell this number (indicate) but put the right number of sticks near it.

Item 5. Do not tell this number (indicate) but put the right number of sticks near it.

"Turn the page over and fold the books back so you see candles."

Page O

Item 1. A girl had a birthday party. She was five years old. She put only four candles on

The first part of the paper discusses the importance of the study of the history of the United States. It is argued that a knowledge of the past is essential for a full understanding of the present. The author then goes on to discuss the various factors which have shaped the development of the United States, including the influence of the British, the Spanish, and the French. He also discusses the role of the American people in the creation of the new nation. The paper concludes by stating that the study of the history of the United States is a task of great importance, and that it is one which should be undertaken by all who are interested in the future of the country.

THE  
HISTORY  
OF  
THE  
UNITED  
STATES

her cake. How many more did she need to make five? Put a mark on one candle.

Item 2. Father gave her three presents. Mother gave her one. Mark how many she got.

Item 3. Mother bought four lollipops. Grandmother bought three lollipops. Mark how many they bought together.

Item 4. The children had to hunt for peanuts. One boy found five peanuts. Another boy found five peanuts. Mark how many they found together.

Item 5. See the party hats. Mother made three for the girls and two for the boys. Mark how many she made all together.

"Turn over so you see balls."

Page P

Item 1. See the balls. A boy had five balls and lost two. How many did he have left? Mark them.

Item 2. Two cars rolled away. Mark how many were left.

Item 3. A boy and his father went fishing. The father caught five fish. The boy caught four. Mark how many they caught all together.

Item.4. A girl had eight crayons. She broke two



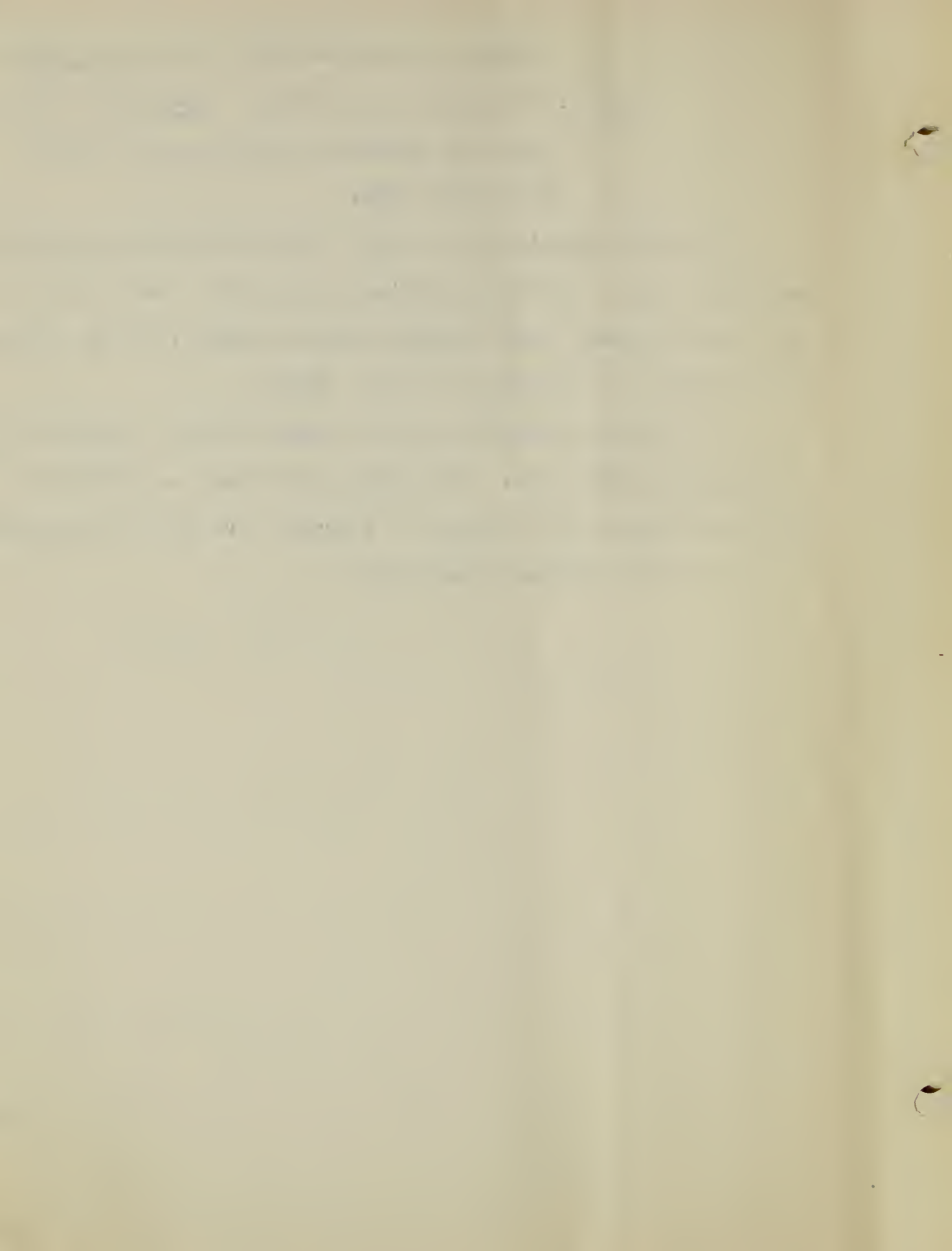
crayons. Mark how many were not broken.

Item 5. A boy had six soldiers. Four fell down.

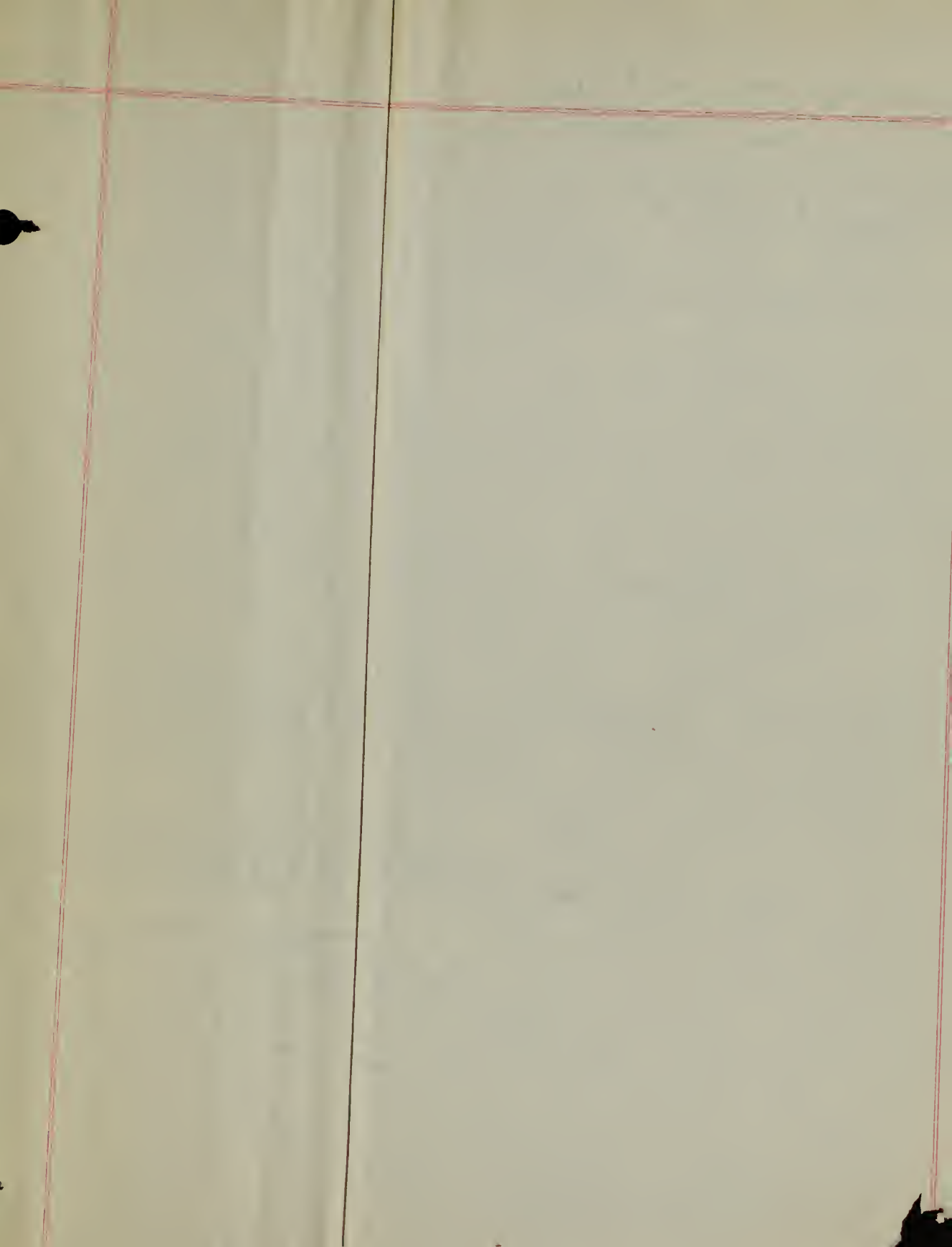
Mark the soldiers that were left after  
four fell down.

The time required for total administration approximates one-half hour. At the beginning of the year the time is longer since frequent rest periods must be given for the children unaccustomed to lengthy sedentary tasks.

The highest possible total score is 64. One point is allowed for each item. The items requiring the formation of numbers (Page M) are judged as correct even if the numbers 4, 9, or 7 are formed incorrectly.









BOSTON UNIVERSITY



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DEMCO

**FOR REFERENCE**

**Do Not Take From This Room**

